



Atmosphere Attenuation and Noise Temperature Models at DSN Antenna Locations for 1–45 GHz

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1. Introduction

Almost all of NASA's deep space missions are tracked by the Deep Space Network (DSN). The distances between the spacecraft and the DSN antennas are large, and the spacecraft usually has only a small amount of power to expend on telecommunications. The total power received by the ground station is very minimal, and it is usually just sufficient to obtain the bit demodulation for a designed bit error rate (BER). There are also spacecraft transmission system losses, channel losses, and receiving system losses present in the link. The two system losses are usually fixed and invariable so that measurement before launch can give a definite idea about their magnitude. The channel loss contains the weather-induced degradation, which causes a loss (attenuation) in the power received, and a system noise temperature increase which increases the noise floor of the system. The weather-induced loss is a function of the frequency of the link, the elevation angle of the DSN ground antenna, oxygen in the atmosphere, and the water content (vapor and liquid) of the atmosphere along the ray path to the spacecraft. The DSN is currently looking at operation at Ka-band because of advantages offered by the use of higher frequencies. However, with Ka-band the weather effects become more significant, compared with S- and X-bands, both in signal loss and in system noise temperature increase. Even though the higher frequency between the transmit and receive antennas implies a net gain after removing the increased space loss, if the weather effects are not accounted for properly, the increase in telecom performance may be minimal. Thus it is of paramount importance that the DSN weather-induced losses be modeled properly, and a software tool has been designed for obtaining the values for the losses and the noise temperature increase.

The Earth's atmosphere plays an important role in the microwave transmission from spacecraft to the ground station, and vice-versa. Spacecraft can transmit over a wide

range of frequencies, from UHF to Ka-band, but the atmosphere behaves differently at different frequencies. As an example, the atmosphere is essentially transparent for frequencies in the 1 to 5 GHz range. Thus, S-band (2.25 GHz) used by the DSN is virtually not affected by the atmosphere unless significant rainfall occurs. At X-band (8.45 GHz), atmospheric effects begin to increase, particularly if liquid water (clouds and rain) is present. At Ka-band (32.05 GHz) the telecom link is affected significantly by all atmosphere constituents, in particular water vapor, clouds, and rain.

The atmospheric pressure, density, and water vapor content all decrease exponentially as the height increases, however the water vapor density is not easily predictable, and it varies as a function of time of day, geographic location, and weather activity.

2. Gaseous Absorption

Absorption of electromagnetic energy by gases usually involves the interaction of the incident electromagnetic field of the propagating wave and the magnetic moments of the gas molecules. There are many gases in the Earth's atmosphere; however, oxygen and water vapor are the only two gases that have any significant absorption of electromagnetic energy from the electromagnetic wave propagating through them. There is no effect from the nitrogen in the atmosphere, even though air is 78% nitrogen and only 21% oxygen. The oxygen molecule has a permanent magnetic moment, and the interaction with the incident field produces a family of absorption lines around 60 GHz (50–70 GHz) and a single line at 118.75 GHz. In the frequency range 55–65 GHz, the atmosphere is virtually opaque, with zenith attenuation exceeding 20 dB. Water vapor is a polar molecule that behaves as an electric dipole. Interaction with the incident electric field of the wave produces absorption lines at 22.235 GHz, 183.31 GHz, and in the frequency range above 300 GHz.

For current telecommunications engineering the most important absorption lines are those of oxygen around 60 GHz and the water vapor lines at 22 and 183 GHz. It should be noted that ideally these spectral lines should have no width, however, the molecules are constantly moving and colliding with each other as well as suffering collision with other objects such as dust particles, rain, and snow, so that the line width increases. This is called the line broadening, or pressure broadening, effect.

3. Water Vapor Absorption

For the frequencies currently suitable for telecommunications, i.e., below 100 GHz, the total water vapor absorption coefficient (sometimes called specific absorption), k_{H_2O} may be written as (Reference 1, Section 5-4):

$$k_{H_2O}(f) = k(f, 22) + k_r(f) \text{ dB/km} \quad (1)$$

Where $k(f, 22)$ is the absorption coefficient of the water vapor absorption line at 22.235 GHz and $k_r(f)$ is the residual term that accounts for the absorption of all higher frequency water vapor lines. $k(f, 22)$ is given by the following expression

$$k(f, 22) = 2 f^2 \rho_v \left(\frac{300}{T} \right)^{5/2} e^{-644/T} \left[\frac{\gamma_1}{(494.4 - f^2)^2 + 4 f^2 \gamma_1^2} \right] \text{ dB/km} \quad (2)$$

where the linewidth parameter γ_1 is given by the following equation.

$$\gamma_1 = 2.85 \left(\frac{P}{1013} \right) \left(\frac{300}{T} \right)^{0.626} \left[1 + 0.018 \frac{\rho_v T}{P} \right] \text{ GHz} \quad (3)$$

In the above equations, γ_1 and f are in GHz, T is in kelvins (K), ρ_v (water vapor density) in gm^{-3} , and P (atmospheric pressure) in millibars (mbar).

The residual absorption coefficient $k_r(f)$ is given by

$$k_r(f) = 2.4 \times 10^{-6} f^2 \rho_v \gamma_1 \left(\frac{300}{T} \right)^{3/2} \text{ dB/km} \quad (4)$$

Hence the total water vapor absorption can be written as

$$k_{H_2O}(f) = 2 f^2 \rho_v \left(\frac{300}{T} \right)^{3/2} \gamma_1 \left[\left(\frac{300}{T} \right) \frac{e^{-644/T}}{(494.4 - f^2)^2 + 4 f^2 \gamma_1^2} + 1.2 \times 10^{-6} \right] \text{ dB/km} \quad (5)$$

For the contribution of water vapor lines above 300 GHz, for use in the 100–300 GHz region, an additional term needs to be added as seen below in Equation (6). For calculations restricted to the range 1–45 GHz, as in this report, this additional term is very small and can be neglected.

$$\begin{aligned} & \text{Modified Water} \\ & \text{Vapor Absorption} = k_{H_2O} + 4.69 \times 10^{-6} \rho_v \left(\frac{300}{T} \right)^{2.1} \left(\frac{P}{1000} \right) f^2 \text{ dB/km} \\ & \text{Coefficient} \end{aligned} \quad (6)$$

4. Oxygen Absorption

At this time, the DSN frequencies of interest are restricted to the 1–45 GHz range. Below 45 GHz, the contribution of the 118.75 GHz oxygen absorption line may be neglected because it is relatively weak compared with the 60 GHz lines, and the low-frequency tail of that line has virtually no contribution below 45 GHz. Below 45 GHz, the oxygen contribution is given by the following formula (Reference 1, Section 5-5):

$$k_{O_2}(f) = 0.011 f^2 \left(\frac{P}{1013} \right) \left(\frac{300}{T} \right)^2 \gamma \left[\frac{1}{(f - 60)^2 + \gamma^2} + \frac{1}{f^2 + \gamma^2} \right] \text{ dB/km} \quad (7)$$

where f is in GHz and the line width parameter γ is given by

$$\gamma = \gamma_0 \left(\frac{P}{1013} \right) \left(\frac{300}{T} \right)^{0.85} \text{ GHz} \quad (8)$$

and γ_0 is defined as given below.

$$\gamma_0 = \begin{cases} 0.59 & P \geq 333 \text{ mbar} \\ 0.59 [1 + 0.0031(333 - P)] & 25 \leq P \leq 333 \text{ mbar} \\ 1.18 & P \leq 25 \text{ mbar} \end{cases} \quad (9)$$

To be consistent with an existing oxygen absorption model in use at JPL¹, the "0.011" factor in Equation (7) has been replaced by

$$0.011 \times (0.000000713 \times f^4 - 0.000092051 \times f^3 + 0.003280422 \times f^2 - 0.01906468 \times f + 1.110303146)$$

¹ S. J. Keihm, Section 382, Instrument Systems Implementation and Concepts, Jet Propulsion Laboratory

(10)

where f = frequency, GHz.

This results in factors of

0.0119 at 2.25 GHz (S-band)

0.0124 at 8.45 GHz (X-band)

0.0169 at 26.0 GHz (K-band)

0.0175 at 32.05 GHz (Ka-band)

At Ka-band, the oxygen absorption is increased about 60% over the values given by Equation (7). This implies a significantly larger value for the linewidth parameter γ than is given in Reference 1.

5. Cloud Absorption

Absorption by clouds (very small liquid water particles) is proportional to the liquid water content of the cloud. The absorption coefficient, k_1 , is given by the following formula (Reference 1, Section 5-11.2):

$$k_1 = f^{a_1} e^{a_2(1 + a_3 T)} \text{ dB/km per g/m}^3 \quad (11)$$

where $a_1 = 1.95$, $a_2 = -6.886$, and $a_3 = 0.0045$

f = frequency, GHz

T = temperature, deg C.

6. Attenuation and Noise Temperature Model Development

The starting point for the weather model generation over the frequency range 1–45 GHz is noise temperature statistics derived from water-vapor radiometer (WVR) measurements at the three DSN sites at Goldstone, California; Canberra, Australia; and Madrid, Spain. There are now more than 10 years of water vapor radiometer data collected at each site. The noise temperature and attenuation statistics derived from these measurements are presented in the Deep Space Mission Systems *DSMS Telecommunications Link Design Handbook*, 810-005 document (Reference 2).

The WVRs measure "zenith sky brightness temperature" at a frequency of 31.4 GHz. Sky brightness temperature is the noise contribution of the atmosphere plus the noise contribution of the cosmic microwave background reduced by the atmosphere attenuation along the line-of-sight of the antenna beam.

This can be written as

$$T_{\text{sky}} = T_{\text{atm}} + \frac{T_{\text{cmb}}}{L_{\text{atm}}} \quad \text{K} \quad (12)$$

where

$$T_{\text{atm}} = \text{atmosphere noise temperature} = T_p \times \left(1 - \frac{1}{L_{\text{atm}}}\right) \quad \text{K}$$

T_p = mean physical temperature of the atmosphere, K

$$L_{\text{atm}} = 10^{\left(\frac{A_{\text{atm}}}{10}\right)} \quad \text{dimensionless, } > 1.0$$

A_{atm} = atmosphere attenuation, dB

T_{cmb} = cosmic microwave background = 2.725 K

Assuming a mean physical temperature of 275 K (the results are relatively insensitive to this value in the range 260 K to 290 K), T_{atm} at 31.4 GHz can be calculated from the measured T_{sky} values as

$$T_{\text{atm}} = T_p \times \left(\frac{T_{\text{sky}} - T_{\text{cmb}}}{T_p - T_{\text{cmb}}} \right)$$

$$= 1.010 \times (T_{\text{sky}} - 2.725) \text{ (K)} \quad \text{for } T_p = 275 \text{ K}$$
(13)

For a statistical description of weather effects, cumulative distributions (CD) of atmospheric noise temperature and attenuation are given as a function of frequency. For example, a cumulative distribution of 0.90 ("90% CD", or "90% weather") means that the noise temperature or attenuation is less than or equal to a particular stated value, 90% of the time.

Qualitatively, $CD = 0.00$ is the driest, lowest loss condition of the atmosphere. $CD = 0.25$ is defined as average-clear weather. $CD = 0.50$ is clear humid or very light clouds. $CD = 0.90$ is very cloudy, but no rain. $CD > 0.95$ is very cloudy, with rain.

For use in the DSN, the 31.4 GHz WVR statistics are converted to the DSN operational frequency of 32 GHz by

$$T_{\text{atm}, 32} = T_{\text{atm}, 31.4} + 5.0 \left(1 - e^{-0.008 * T_{\text{atm}, 31.4}} \right)$$
(14)

This noise temperature adjustment ranges from about 0.3 K to 2 K over the range of normally encountered atmosphere noise temperatures.

For $CD = 0.90$ at Goldstone (WVR data current through July, 2006),

$T_{\text{atm, zenith, 31.4}} = 14.559 \text{ K}$, and $T_{\text{atm, zenith, 32}} = 15.108 \text{ K}$, for the year-average data set.

Thus, from 31.4 GHz raw data measurements of T_{sky} at zenith, atmosphere noise temperature statistics at zenith can be calculated for each of the DSN locations at 32

GHz. From the noise temperature statistics at zenith, atmospheric attenuation statistics at zenith can be calculated as follows:

The mean physical temperature of the atmosphere is defined as

$$T_p = 255 + 25 * CD \quad K \quad (15)$$

where CD = cumulative distribution of the noise temperature statistics ($0 \leq CD \leq 1$)

$$L_{atm} = \frac{T_p}{T_p - T_{atm}} \quad (16)$$

at each CD value. Atmospheric attenuation is given by

$$A_{atm} = 10 * \log_{10}(L_{atm}) \quad dB \quad (17)$$

For example, for $CD = 0.90$, the $T_{atm,32}$ at zenith is 15.108 K (Goldstone, with WVR data current through July, 2006).

$$T_p = 255 + 25 * 0.9 = 277.5 K \quad (18)$$

$$L_{atm} = 277.5 / (277.5 - 15.108) = 1.05758$$

$$A_{atm} = 0.243 \quad dB$$

In this way, A_{atm} statistics at 32 GHz can be developed from the T_{atm} statistics at 32 GHz for the full range of desired CD values.

To determine the T_{atm} and A_{atm} statistics at other frequencies in the 1–45 GHz range, the starting point is the T_{atm} statistics at the three DSN sites at 32 GHz. Clearly, these particular values can be obtained by an infinite number of combinations of oxygen,

water vapor, and liquid water (clouds). The noise temperature value at any CD can arise from either a "humid" atmosphere (water vapor predominant, as would be typical of the Mojave Desert in the late summer with a monsoonal flow) or a "wet" atmosphere (liquid water, clouds, predominant, as would be typical of a cool dry cloudy winter in the desert), or a combination of both. Additionally, the other contributor to atmosphere noise temperature and attenuation is oxygen, whose noise contribution is relatively constant as a function of CD, and depends primarily on the height of the DSN station above sea level (the pressure dependence). The effects of rain were not considered in the development of the 1–45 GHz atmosphere effects model.

As the noise and attenuation contributions due to water vapor and liquid water vary quite differently with frequency, for the purpose of model development two separate atmospheres were postulated, each of which would give the same noise temperature contribution at 32 GHz, at each CD level, for which the measured statistics exist. The plan for calculating the atmosphere noise and attenuation model at other frequencies is to calculate the effects for the two different atmospheres, then average the results at the frequency of interest. Obviously, at 32 GHz, both postulated atmospheres give the same value as the existing 32-GHz statistical model.

For example, for Goldstone at 32 GHz, at CD = 0.90, the following "humid" atmosphere model would yield the 15.108 K value as given in the noise temperature statistics:

surface temperature = 32.0° C

surface pressure = 899.2 mbar

(normal for a height of 0.991 km above sea level)

relative humidity at the surface = 0.2648 (26.48%)

absolute humidity at the surface = 8.970 g/m^3 water vapor

liquid water density in a cloud, 2 km thick, 1–3 km above the surface
= 0.0 g/m^3 (no cloud for the humid atmosphere)

For a "wet" atmosphere, with little water vapor (water vapor density = 1 g/m³ at the surface), and a 2-km thick cloud layer containing liquid water,

surface temperature = 10° C

surface pressure = 899.2 mbar

relative humidity at the surface = 0.1064 (10.64%)

absolute humidity at the surface = 1.0 g/m³ water vapor

liquid water density in a cloud, 2 km thick, 1–3 km above the surface

= 0.0607 g/m³

The liquid water density is commonly referred to as liquid water content, LWC, in grams per cubic meter. The absolute humidity for a standard atmosphere has a water vapor (non-liquid) density of = 7.5 g/m³.

Both the humid and wet atmospheres at Goldstone give a CD = 0.90 noise temperature at zenith of 15.108 K at 32 GHz, duplicating the existing weather statistics.

Similarly, two distinct atmospheres can be postulated for each DSN location, at all CDs from 0.00 to 0.99, as given in the existing 32-GHz weather statistics. One slight problem arose for Canberra and Madrid humid atmospheres at high CD values greater than about 0.94. The air at even the high temperatures (above 33°C) could not contain enough water vapor to duplicate the noise temperature values at those CDs, so a small amount of liquid water was added to the humid atmosphere at the high CD values to generate the noise temperature values.

Appendix 1 shows the postulated humid and wet atmospheres for the three DSN locations at all CDs.

Calculations of atmospheric noise temperature in an existing surface weather model are made using the radiative transfer equation, which is described in Reference 3. In this method, the atmosphere is broken up into 300 layers, each 0.1 km thick,

extending from the surface to a height 30 km (98430 feet) above the surface. Particular models of oxygen temperature and pressure, and water vapor density with height are used. Typically, the temperature profile decreases from the surface temperature at a rate of 6.5 K/km above the surface, until a constant temperature of 217 K is reached at the tropopause level, approximately 10.5 km above sea level. The oxygen pressure is reduced exponentially with a variable scale height of approximately 8 km. The surface water vapor density (g/m^3) is calculated from the surface temperature and relative humidity, and the density is reduced exponentially from the surface value with a scale height of 2 km:

$$\rho = \rho_{\text{surface}} \times e^{-\frac{h}{2}} \quad \text{g/m}^3 \quad (19)$$

where ρ and ρ_{surface} are the water vapor density values above the surface and at the surface.

Radiative transfer calculations "add up" the effects at the ground of all the individual layers in the atmosphere. At each layer, a specific attenuation (dB/km) can be calculated, as described above. The specific attenuation of each layer is the sum of the specific attenuations of oxygen, water vapor and cloud. The total attenuation of the layer is calculated from

$$A_{\text{layer,total}} (\text{dB}) = A_{\text{layer}} (\text{dB/km}) * dl (\text{km})$$

where dl = slant path length through the atmosphere.

(20)

The noise temperature emission of this single layer can be calculated by a method similar to Equation (12) (T_{atm}), as described in Reference 3. That emitted noise temperature is reduced by the attenuation along the slant path of all the layers between it and the antenna on the ground. The net noise temperature of the atmosphere is the sum of all 300 attenuated noise temperatures in the atmosphere.

The atmospheric attenuation and noise temperature can be calculated by the radiative transfer technique for the distinct humid and wet atmosphere models shown in Appendix 1 at the three DSN antenna locations, at frequencies from 1-45 GHz, at elevation angles from zenith down to 0.5 degrees (using a round-earth model), and for all 20 CD values ranging from 0.00 to 0.99. The program used for calculating the weather model in this report is derived from the surface weather model.

When translating from 32 GHz to 26 GHz (for example) this calculation typically resulted in two somewhat different numbers, as the water vapor effect increased with decreasing frequency (approximately as $1/\text{frequency}^2$ on the high side of the water vapor line at 22.235 GHz), and the liquid water effect decreased with decreasing frequency (approximately as frequency^2).

For Goldstone at 32 GHz, 90% CD, both the humid and wet models give a zenith noise temperature of 15.108 K (as the modeled atmospheres were chosen to give). The calculated attenuation values are slightly different, 0.251 dB for the humid atmosphere, and 0.258 dB for the wet atmosphere. This difference arises from the distribution of the attenuating constituents in the atmosphere, which are at different physical temperatures. The attenuation differences are small, and have no practical effect on telecom link model analysis.

Using the same two atmosphere models, but calculating the effects at 26 GHz, we find that for the humid model $T_{\text{atm}} = 17.035$ K, and $A_{\text{atm}} = 0.279$ dB, at zenith. For the wet model, $T_{\text{atm}} = 10.919$ K, and $A_{\text{atm}} = 0.184$ dB. For this report, the two sets of values are averaged, and the result defines the atmospheric noise temperature and attenuation at the frequency of interest. Thus at 26 GHz, $T_{\text{atm}} = 13.977$ K, and $A_{\text{atm}} = 0.232$ dB. These results are seen in the graphs (Appendix 2) for Goldstone, CD = 0.90, the bottom curves for 90-degree elevation angle. The noise temperature differences (± 3.058 K) and the attenuation differences (± 0.048 dB) should be considered $\pm 3\sigma$ variations in the confidence of the numbers at the new frequencies. In this case, 3σ amounts to about 22% of the mean noise temperature value of 13.977 K, and 21% of the mean attenuation value in dB. These tolerances are not readily available from the Attenuation and Noise Predictor program described in

Section 7, but the values calculated here can give the user some idea of the possible uncertainties in the model.

7. Atmospheric Loss and System Noise Temperature Computation Software

The atmosphere at the desired DSN antenna station is assumed to be 30 km thick and is divided into 300 layers of 0.1 km thickness. Depending upon the elevation angle selected, the slant path through the 0.1-km thickness layers is computed. The total oxygen attenuation of each layer at the elevation angle of interest is computed, along with the total water-vapor attenuation of the layer at the given elevation angle. Next, cloud attenuation in the layer is computed, along with the rain attenuation in the layer (No rain is considered for the modeling in this report). The computations using radiative transfer, as described in Section 6, are repeated until all the desired elevation angles and different frequencies of interest are covered. All the results are recorded in a database. The program was written in Microsoft Excel and Visual Basic, and it is based on the surface weather model mentioned in Section 6. Once the results are generated, plotting of the desired quantities can be done according to a user request. The software was run for DSN stations at Goldstone, Canberra, and Madrid; and the plots of atmospheric attenuation and system noise temperature increase are shown for each complex, for different frequencies and different elevation angles. These plots are expected to be useful for link design for various spacecraft using the DSN frequencies at S-, X-, K-, and Ka-bands, and at non-DSN frequencies.

Figure 1 shows the user interface and results from the run. The user interface of the program shows the available cumulative distribution (CD) values, ranging from 0.00 to 0.99 as follows: 0.0, 0.1, 0.2, 0.25, 0.3, 0.4, 0.5, 0.6, 0.7, 0.8, 0.85, 0.9, 0.92, 0.93, 0.94, 0.95, 0.96, 0.97, 0.98, and 0.99 as shown in the box. In all, there are 20 CD values. The user selects one of the CD value boxes.

ATMOSPHERIC ATTENUATION AND NOISE PREDICTOR			
Desired DSN Station	<input type="radio"/> Goldstone	<input type="radio"/> Canberra	<input checked="" type="radio"/> Madrid
Selected Desired CD Value	0.7	Select Desired CD value: <input type="checkbox"/> 0.0 <input type="checkbox"/> 0.10 <input type="checkbox"/> 0.20 <input type="checkbox"/> 0.25 <input type="checkbox"/> 0.30 <input type="checkbox"/> 0.40 <input type="checkbox"/> 0.50 <input type="checkbox"/> 0.60 <input checked="" type="checkbox"/> 0.70 <input type="checkbox"/> 0.80 <input type="checkbox"/> 0.85 <input type="checkbox"/> 0.90 <input type="checkbox"/> 0.92 <input type="checkbox"/> 0.93 <input type="checkbox"/> 0.94 <input type="checkbox"/> 0.95 <input type="checkbox"/> 0.96 <input type="checkbox"/> 0.97 <input type="checkbox"/> 0.98 <input type="checkbox"/> 0.99	
Desired Frequency (GHz)	25.9		
Desired Elevation Angle (Deg)	90		
Attenuation (dB)	0.223	Outputs	
Temperature Increase (K)	13.453		

Figure 1. Atmospheric Attenuation and Noise Predictor Input Display

Figure 1 shows 0.7 selected as the CD value. Once the user selects the CD value desired, this value appears in the grayed out cell to the left of the "Select Desired CD value" box. The cell is grayed out because this cell is protected and cannot be changed. The blue section of the table is the user-inputs area. Once the user completes the blue section, the attenuation in dB and the system noise temperature increase values will be automatically computed and shown in the green area that is reserved for the outputs of the program. In the first blue line in the blue section the user can select the DSN site of interest, and the display results will change accordingly.

To the right of the user interface box, two buttons are provided, one above the other. The button marked "Graphics" will plot two plots. The first plot is atmospheric attenuation as a function of frequency of the link, with elevation angle as the parameter of the graph. The second one is atmosphere noise temperature at the station as a function of frequency and elevation angle, as before. These graphical outputs are shown in Appendix 2. The range of frequency on the X-axis will be from 1 to 45 GHz, while the elevation angle parameter will range from 0.5 to 90 degrees. The elevation angle values considered for both the graphs are 0.5, 1, 2, 3, 4, 5, 6, 8, 10,

Graphics

Elevation Angle & CD Variation

12, 15, 20, 25, 30, 35, 40, 45, 50, 60, 70, 80, 90 degrees. The curves for an elevation angle of 30 degrees are drawn in bold, as a reference curve.

Thus, for each value of CD shown in Figure 1, there would be two different plots, one for atmospheric attenuation and the other for atmosphere noise temperature, and each plot will have 22 curves, one for each elevation angle given above. This gives sufficient diversity for the user to obtain the desired value of the atmosphere loss and noise temperature. There are 20 CD values, and each CD value has two plots associated with it. Finally, there are three stations, giving a total of 120 plots ($20 \times 2 \times 3$). All these plots are shown in Appendix 2 under the headings of "Goldstone", "Canberra", and "Madrid", so that the user could simply read off the desired values and not need to run the software.

The second button labeled "Elevation Angle and CD Variation" allows the user to generate a table of CD, elevation angle, atmospheric attenuation, and atmospheric noise temperature. Once this button is pressed the program leads the user through all the necessary inputs and the program automatically generates the table mentioned above. Appendix 3 shows DSN S-, X-, Ka-, and K-band frequency-related loss and atmosphere noise temperature in tabular form.

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(<http://eis.jpl.nasa.gov/deepspace/dsndocs/810-005/>)
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Appendix 1 –

**Goldstone, Canberra, and Madrid Humid and Wet
Atmosphere Parameters**

Goldstone Humid Atmosphere Parameters

CD	Frequency	Surface	Surface	Surface	Surface Absolute	Station Height	Elevation	Cloud LWC	Tatm, K
	GHz	Temperature, C	Pressure, mb	Relative Humidity	Humidity, g/m^3	km, msl	Angle, deg	g/m^3	at 32 GHz
0.00	32	5.000	899.2	0.0000	0.000	0.991	90	0	6.693
0.10	32	8.000	899.2	0.1785	1.476	0.991	90	0	8.174
0.20	32	11.000	899.2	0.2152	2.155	0.991	90	0	8.802
0.25	32	12.500	899.2	0.2229	2.453	0.991	90	0	9.073
0.30	32	14.000	899.2	0.2267	2.738	0.991	90	0	9.332
0.40	32	17.000	899.2	0.2300	3.334	0.991	90	0	9.874
0.50	32	20.000	899.2	0.2309	3.999	0.991	90	0	10.481
0.60	32	23.000	899.2	0.2332	4.805	0.991	90	0	11.221
0.70	32	26.000	899.2	0.2363	5.769	0.991	90	0	12.109
0.80	32	29.000	899.2	0.2424	6.984	0.991	90	0	13.239
0.85	32	30.500	899.2	0.2494	7.795	0.991	90	0	13.998
0.90	32	32.000	899.2	0.2648	8.970	0.991	90	0	15.108
0.92	32	32.600	899.2	0.2786	9.743	0.991	90	0	15.846
0.93	32	32.900	899.2	0.2900	10.304	0.991	90	0	16.385
0.94	32	33.200	899.2	0.3054	11.025	0.991	90	0	17.079
0.95	32	33.500	899.2	0.3278	12.023	0.991	90	0	18.040
0.96	32	33.800	899.2	0.3619	13.484	0.991	90	0	19.461
0.97	32	34.100	899.2	0.4174	15.799	0.991	90	0	21.721
0.98	32	34.400	899.2	0.5319	20.452	0.991	90	0	26.305
0.99	32	34.700	899.2	0.7900	30.857	0.991	90	0	36.725

NOTE: Cloud base height = 1 km above surface, top height = 3 km above surface

Canberra Humid Atmosphere Parameters

CD	Frequency	Surface	Surface	Surface	Surface Absolute	Station Height	Elevation	Cloud LWC	Tatm, K
	GHz	Temperature, C	Pressure, mb	Relative Humidity	Humidity, g/m^3	km, msl	Angle, deg	g/m^3	at 32 GHz
0.00	32	5.000	934.58	0.0000	0.000	0.673	90	0	7.173
0.10	32	8.000	934.58	0.4305	3.559	0.673	90	0	10.796
0.20	32	11.000	934.58	0.4568	4.575	0.673	90	0	11.778
0.25	32	12.500	934.58	0.4545	5.001	0.673	90	0	12.185
0.30	32	14.000	934.58	0.4484	5.415	0.673	90	0	12.579
0.40	32	17.000	934.58	0.4305	6.239	0.673	90	0	13.362
0.50	32	20.000	934.58	0.4128	7.149	0.673	90	0	14.230
0.60	32	23.000	934.58	0.4009	8.261	0.673	90	0	15.295
0.70	32	26.000	934.58	0.3975	9.705	0.673	90	0	16.692
0.80	32	29.000	934.58	0.4136	11.917	0.673	90	0	18.859
0.85	32	30.500	934.58	0.4404	13.765	0.673	90	0	20.688
0.90	32	32.000	934.58	0.5090	17.242	0.673	90	0	24.173
0.92	32	32.600	934.58	0.5693	19.910	0.673	90	0	26.873
0.93	32	32.900	934.58	0.6137	21.806	0.673	90	0	28.798
0.94	32	33.200	934.58	0.6736	24.317	0.673	90	0	31.363
0.95	32	33.500	934.58	0.6809	24.973	0.673	90	0.031	35.134
0.96	32	33.800	934.58	0.6703	24.976	0.673	90	0.085	40.431
0.97	32	34.100	934.58	0.6609	25.016	0.673	90	0.166	48.199
0.98	32	34.400	934.58	0.6498	24.986	0.673	90	0.298	60.218
0.99	32	34.700	934.58	0.6407	25.025	0.673	90	0.564	82.635

NOTE: Cloud base height = 1 km above surface, top height = 3 km above surface

Madrid Humid Atmosphere Parameters

CD	Frequency	Surface	Surface	Surface	Surface Absolute	Station Height	Elevation	Cloud LWC	Tatm, K
	GHz	Temperature, C	Pressure, mb	Relative Humidity	Humidity, g/m^3	km, msl	Angle, deg	g/m^3	at 32 GHz
0.00	32	5.000	924.23	0.0000	0.000	0.765	90	0	7.031
0.10	32	8.000	924.23	0.2948	2.437	0.765	90	0	9.503
0.20	32	11.000	924.23	0.3387	3.392	0.765	90	0	10.417
0.25	32	12.500	924.23	0.3440	3.785	0.765	90	0	10.788
0.30	32	14.000	924.23	0.3448	4.164	0.765	90	0	11.145
0.40	32	17.000	924.23	0.3416	4.951	0.765	90	0	11.865
0.50	32	20.000	924.23	0.3336	5.777	0.765	90	0	12.663
0.60	32	23.000	924.23	0.3273	6.744	0.765	90	0	13.575
0.70	32	26.000	924.23	0.3263	7.966	0.765	90	0	14.739
0.80	32	29.000	924.23	0.3480	10.027	0.765	90	0	16.735
0.85	32	30.500	924.23	0.3890	12.159	0.765	90	0	18.824
0.90	32	32.000	924.23	0.5107	17.299	0.765	90	0	23.941
0.92	32	32.600	924.23	0.6148	21.501	0.765	90	0	28.170
0.93	32	32.900	924.23	0.6883	24.457	0.765	90	0	31.171
0.94	32	33.200	924.23	0.6811	24.588	0.765	90	0.035	34.858
0.95	32	33.500	924.23	0.6798	24.933	0.765	90	0.075	39.198
0.96	32	33.800	924.23	0.6717	25.028	0.765	90	0.128	44.474
0.97	32	34.100	924.23	0.6586	24.929	0.765	90	0.198	51.046
0.98	32	34.400	924.23	0.6502	25.001	0.765	90	0.299	60.397
0.99	32	34.700	924.23	0.6397	24.986	0.765	90	0.493	77.153

NOTE: Cloud base height = 1 km above surface, top height = 3 km above surface

Goldstone Wet Atmosphere Parameters

CD	Frequency	Surface Temperature, C	Surface Pressure, mb	Surface Relative Humidity	Surface Absolute Humidity, g/m^3	Station Height km, msl	Elevation Angle, deg	Cloud LWC g/m^3	Tatm, K at 32 GHz
		GHz							
0.00	32	10.000	899.2	0.000001	1.000	0.991	90	0.0000	6.693
0.10	32	10.000	899.2	0.1064	1.000	0.991	90	0.0039	8.174
0.20	32	10.000	899.2	0.1064	1.000	0.991	90	0.0089	8.802
0.25	32	10.000	899.2	0.1064	1.000	0.991	90	0.0111	9.073
0.30	32	10.000	899.2	0.1064	1.000	0.991	90	0.0132	9.332
0.40	32	10.000	899.2	0.1064	1.000	0.991	90	0.0176	9.874
0.50	32	10.000	899.2	0.1064	1.000	0.991	90	0.0226	10.481
0.60	32	10.000	899.2	0.1064	1.000	0.991	90	0.0286	11.221
0.70	32	10.000	899.2	0.1064	1.000	0.991	90	0.0359	12.109
0.80	32	10.000	899.2	0.1064	1.000	0.991	90	0.0450	13.239
0.85	32	10.000	899.2	0.1064	1.000	0.991	90	0.0515	13.998
0.90	32	10.000	899.2	0.1064	1.000	0.991	90	0.0607	15.108
0.92	32	10.000	899.2	0.1064	1.000	0.991	90	0.0669	15.846
0.93	32	10.000	899.2	0.1064	1.000	0.991	90	0.0713	16.385
0.94	32	10.000	899.2	0.1064	1.000	0.991	90	0.0771	17.079
0.95	32	10.000	899.2	0.1064	1.000	0.991	90	0.0852	18.040
0.96	32	10.000	899.2	0.1064	1.000	0.991	90	0.0971	19.461
0.97	32	10.000	899.2	0.1064	1.000	0.991	90	0.1164	21.721
0.98	32	10.000	899.2	0.1064	1.000	0.991	90	0.1557	26.305
0.99	32	10.000	899.2	0.1064	1.000	0.991	90	0.2483	36.725

NOTE: Cloud base height = 1 km above surface, top height = 3 km above surface

Canberra Wet Atmosphere Parameters

CD	Frequency	Surface Temperature, C	Surface Pressure, mb	Surface Relative Humidity	Surface Absolute Humidity, g/m^3	Station Height km, msl	Elevation Angle, deg	Cloud LWC g/m^3	Tatm, K at 32 GHz
	GHz								
0.00	32	10.000	934.58	0.000001	1.000	0.673	90	0.0000	7.173
0.10	32	10.000	934.58	0.1064	1.000	0.673	90	0.0220	10.796
0.20	32	10.000	934.58	0.1064	1.000	0.673	90	0.0305	11.778
0.25	32	10.000	934.58	0.1064	1.000	0.673	90	0.0341	12.185
0.30	32	10.000	934.58	0.1064	1.000	0.673	90	0.0374	12.579
0.40	32	10.000	934.58	0.1064	1.000	0.673	90	0.0442	13.362
0.50	32	10.000	934.58	0.1064	1.000	0.673	90	0.0517	14.230
0.60	32	10.000	934.58	0.1064	1.000	0.673	90	0.0610	15.295
0.70	32	10.000	934.58	0.1064	1.000	0.673	90	0.0733	16.692
0.80	32	10.000	934.58	0.1064	1.000	0.673	90	0.0924	18.859
0.85	32	10.000	934.58	0.1064	1.000	0.673	90	0.1086	20.688
0.90	32	10.000	934.58	0.1064	1.000	0.673	90	0.1399	24.173
0.92	32	10.000	934.58	0.1064	1.000	0.673	90	0.1645	26.873
0.93	32	10.000	934.58	0.1064	1.000	0.673	90	0.1821	28.798
0.94	32	10.000	934.58	0.1064	1.000	0.673	90	0.2058	31.363
0.95	32	10.000	934.58	0.1064	1.000	0.673	90	0.2413	35.134
0.96	32	10.000	934.58	0.1064	1.000	0.673	90	0.2920	40.431
0.97	32	10.000	934.58	0.1064	1.000	0.673	90	0.3684	48.199
0.98	32	10.000	934.58	0.1064	1.000	0.673	90	0.4921	60.218
0.99	32	10.000	934.58	0.1064	1.000	0.673	90	0.7427	82.635

NOTE: Cloud base height = 1 km above surface, top height = 3 km above surface

Madrid Wet Atmosphere Parameters

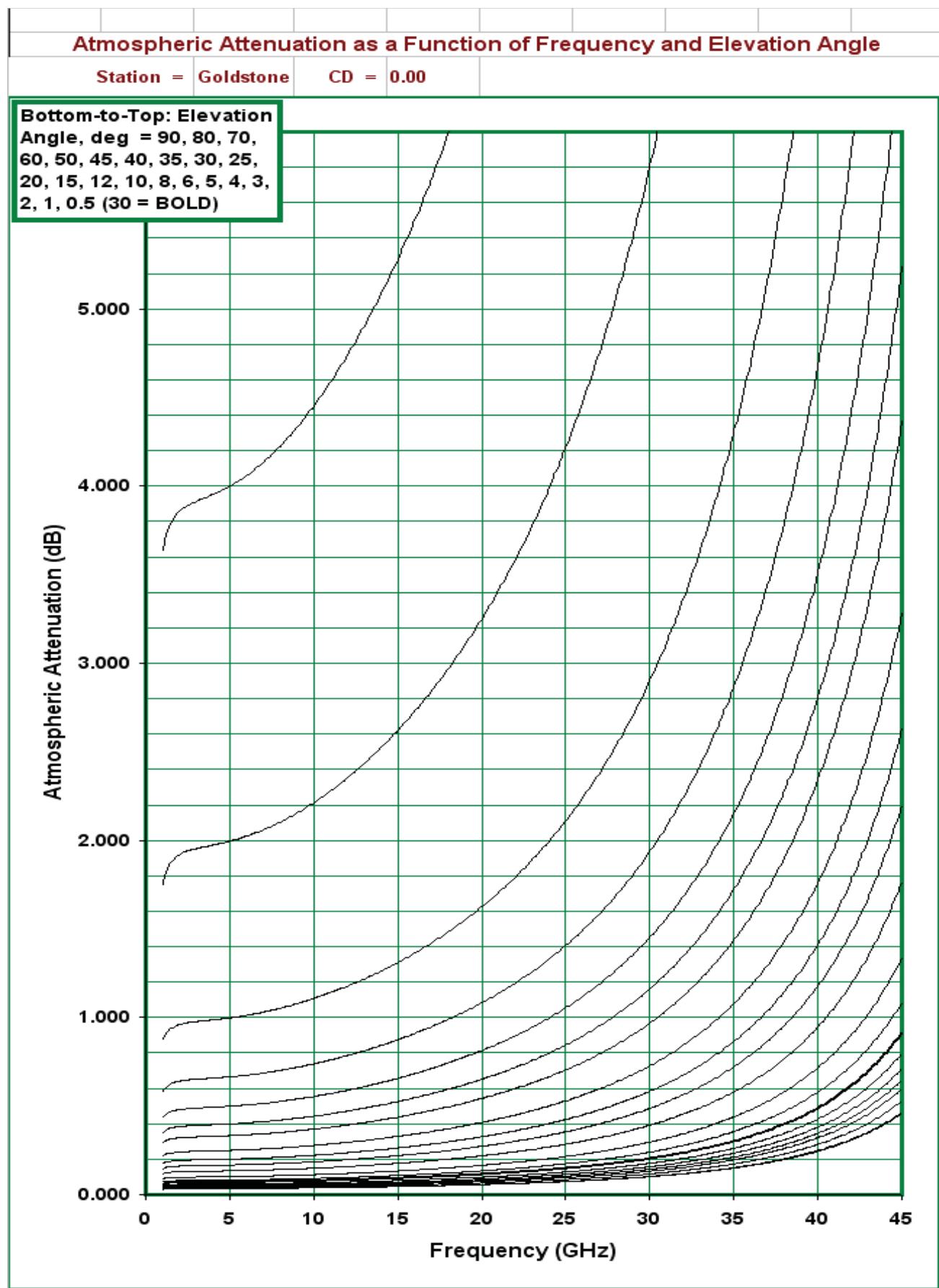
CD	Frequency	Surface GHz	Surface Temperature, C	Surface Pressure, mb	Surface Relative Humidity	Surface Absolute Humidity, g/m^3	Station Height km, msl	Elevation Angle, deg	Cloud LWC g/m^3	Tatm, K at 32 GHz
0.00	32	10.000	924.23	0.000001	1.000	0.765	90	0.0000	7.031	
0.10	32	10.000	924.23	0.1064	1.000	0.765	90	0.0121	9.503	
0.20	32	10.000	924.23	0.1064	1.000	0.765	90	0.0198	10.417	
0.25	32	10.000	924.23	0.1064	1.000	0.765	90	0.0229	10.788	
0.30	32	10.000	924.23	0.1064	1.000	0.765	90	0.0259	11.145	
0.40	32	10.000	924.23	0.1064	1.000	0.765	90	0.0321	11.865	
0.50	32	10.000	924.23	0.1064	1.000	0.765	90	0.0389	12.663	
0.60	32	10.000	924.23	0.1064	1.000	0.765	90	0.0467	13.575	
0.70	32	10.000	924.23	0.1064	1.000	0.765	90	0.0566	14.739	
0.80	32	10.000	924.23	0.1064	1.000	0.765	90	0.0738	16.735	
0.85	32	10.000	924.23	0.1064	1.000	0.765	90	0.0920	18.824	
0.90	32	10.000	924.23	0.1064	1.000	0.765	90	0.1371	23.941	
0.92	32	10.000	924.23	0.1064	1.000	0.765	90	0.1751	28.170	
0.93	32	10.000	924.23	0.1064	1.000	0.765	90	0.2025	31.171	
0.94	32	10.000	924.23	0.1064	1.000	0.765	90	0.2365	34.858	
0.95	32	10.000	924.23	0.1064	1.000	0.765	90	0.2774	39.198	
0.96	32	10.000	924.23	0.1064	1.000	0.765	90	0.3280	44.474	
0.97	32	10.000	924.23	0.1064	1.000	0.765	90	0.3928	51.046	
0.98	32	10.000	924.23	0.1064	1.000	0.765	90	0.4883	60.397	
0.99	32	10.000	924.23	0.1064	1.000	0.765	90	0.6707	77.153	

NOTE: Cloud base height = 1 km above surface, top height = 3 km above surface

Appendix 2 –

Plots of Atmosphere Attenuation and Noise Temperature as a Function of Frequency and Elevation Angle

Goldstone Stations



Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

Station = Goldstone

CD = 0.00

as a Function of Frequency and Elevation Angle

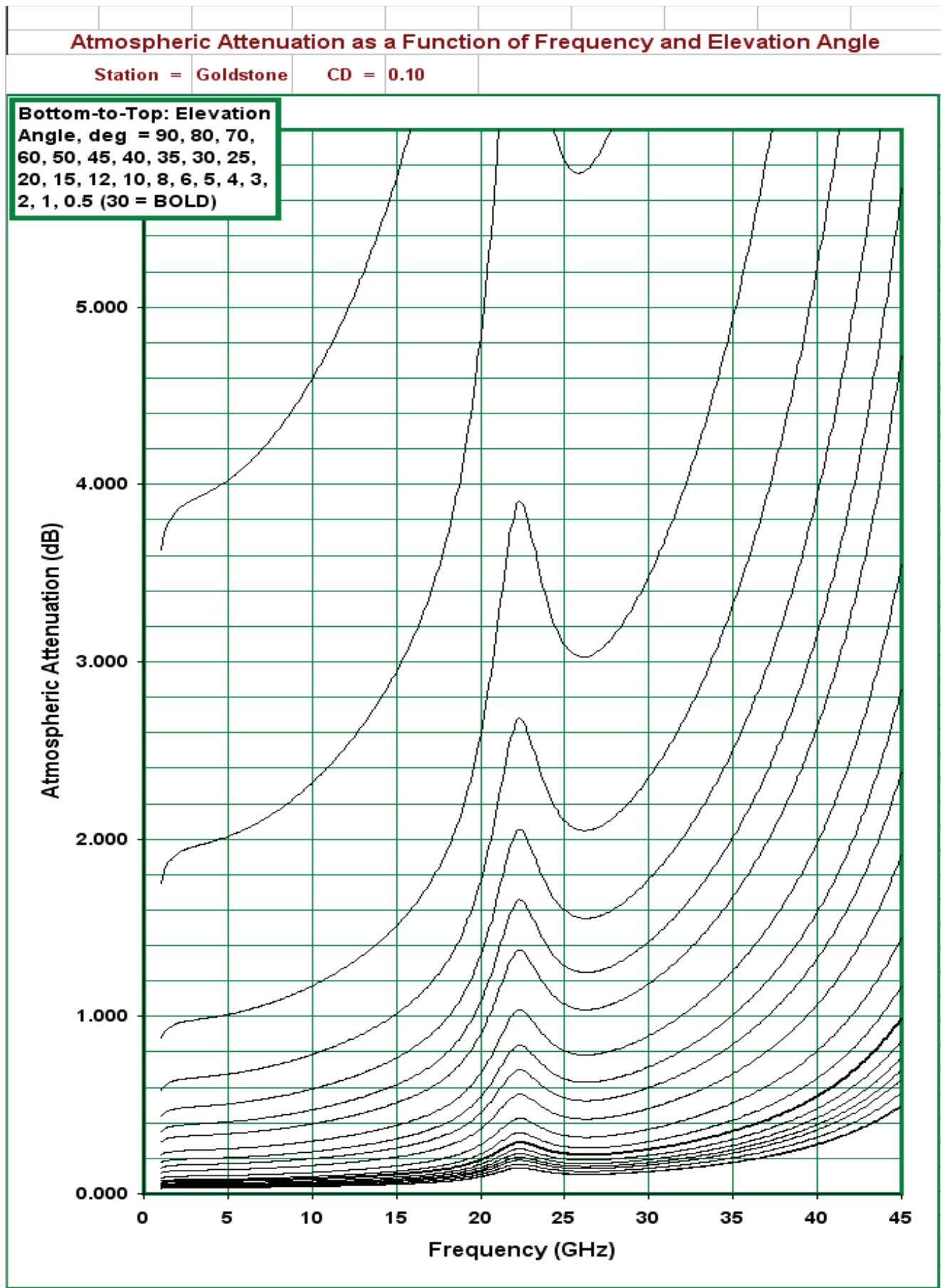
Bottom-to-Top: Elevation
Angle, deg = 90, 80, 70,
60, 50, 45, 40, 35, 30, 25,
20, 15, 12, 10, 8, 6, 5, 4, 3,
2, 1, 0.5 (30 = BOLD)

Atmospheric Temperature (K)

250.00
200.00
150.00
100.00
50.00
0.00

0 5 10 15 20 25 30 35 40 45

Frequency (GHz)



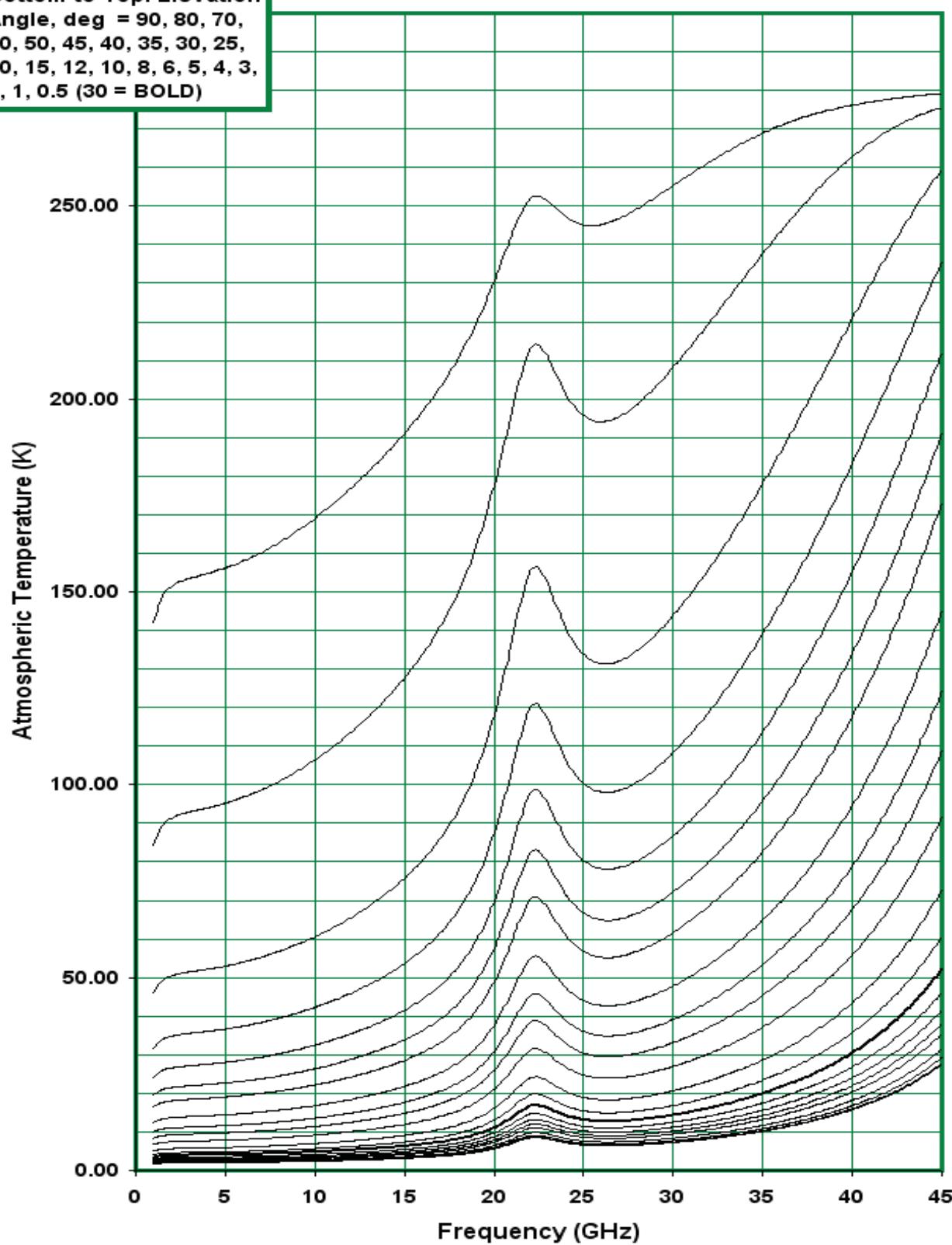
Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

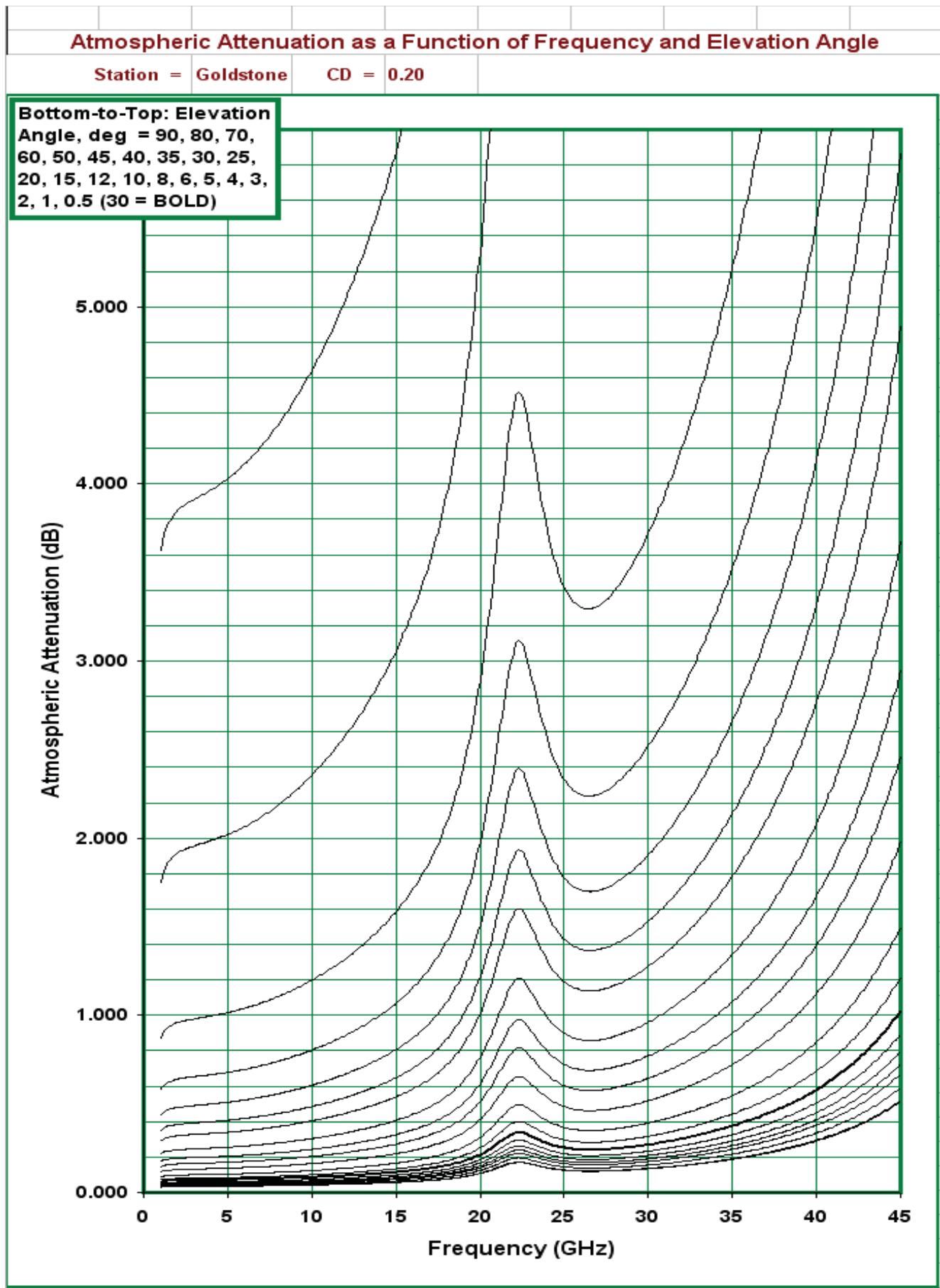
Station = Goldstone

CD = 0.10

as a Function of Frequency and Elevation Angle

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)





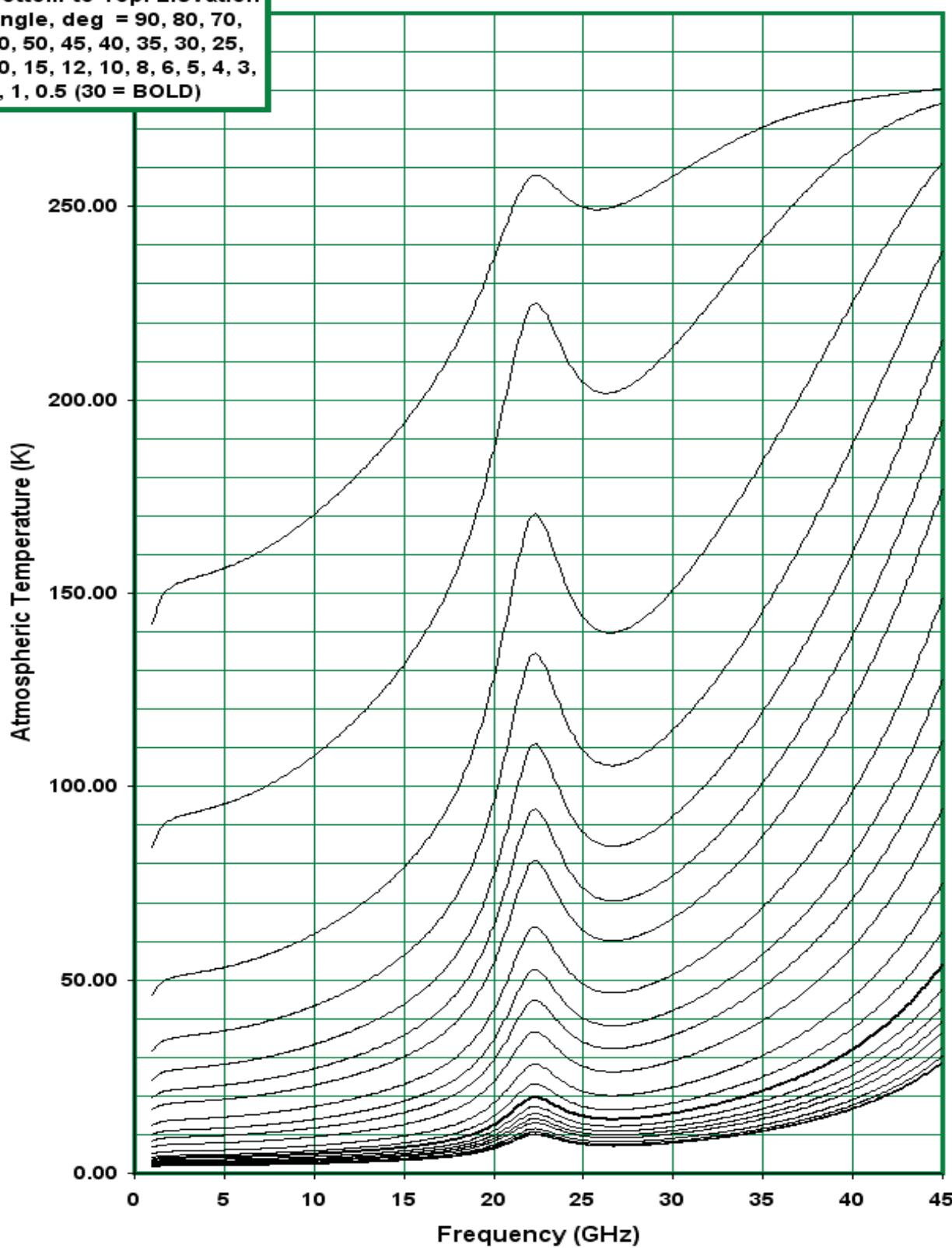
Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

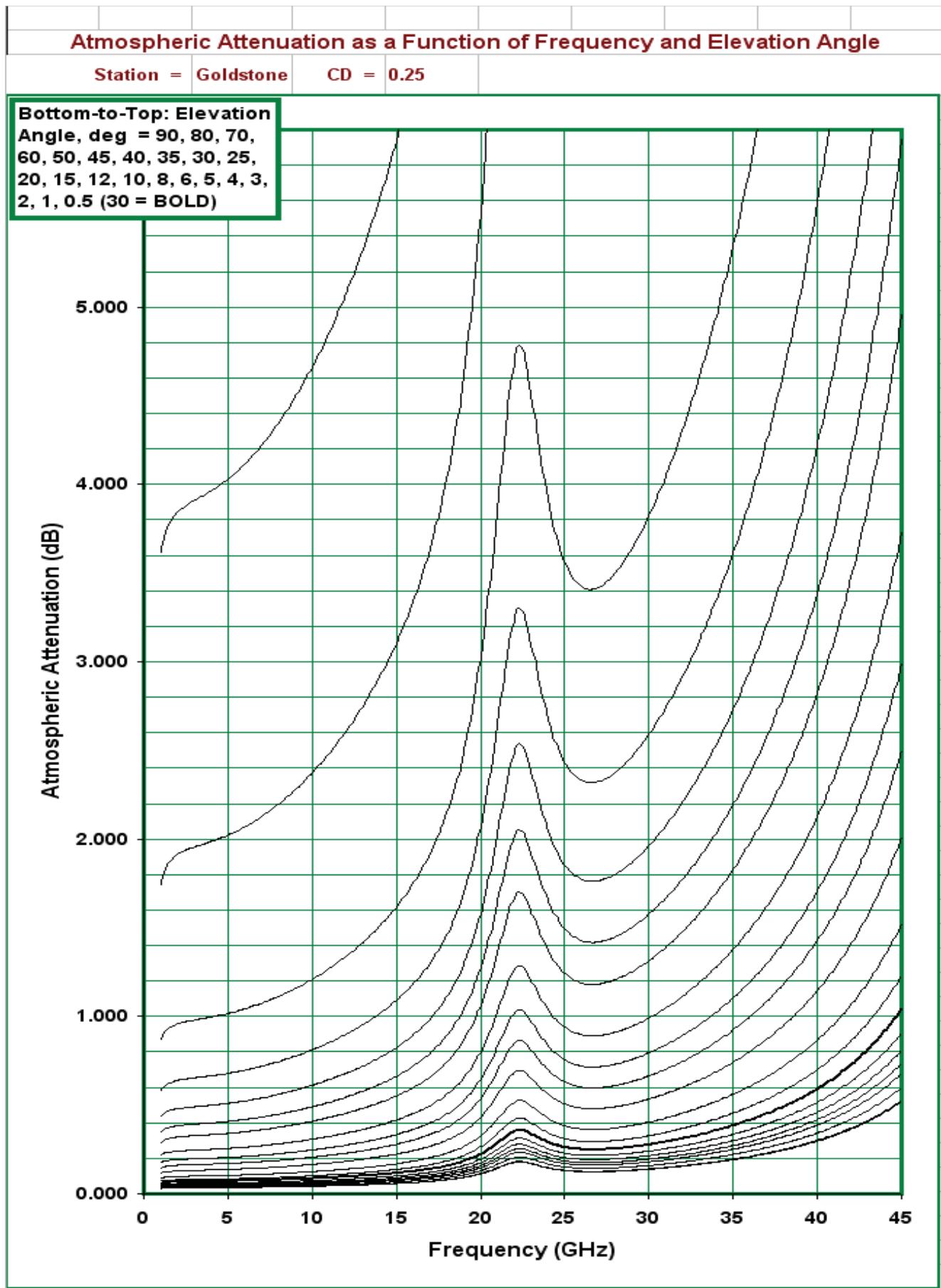
Station = Goldstone

CD = 0.20

as a Function of Frequency and Elevation Angle

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)





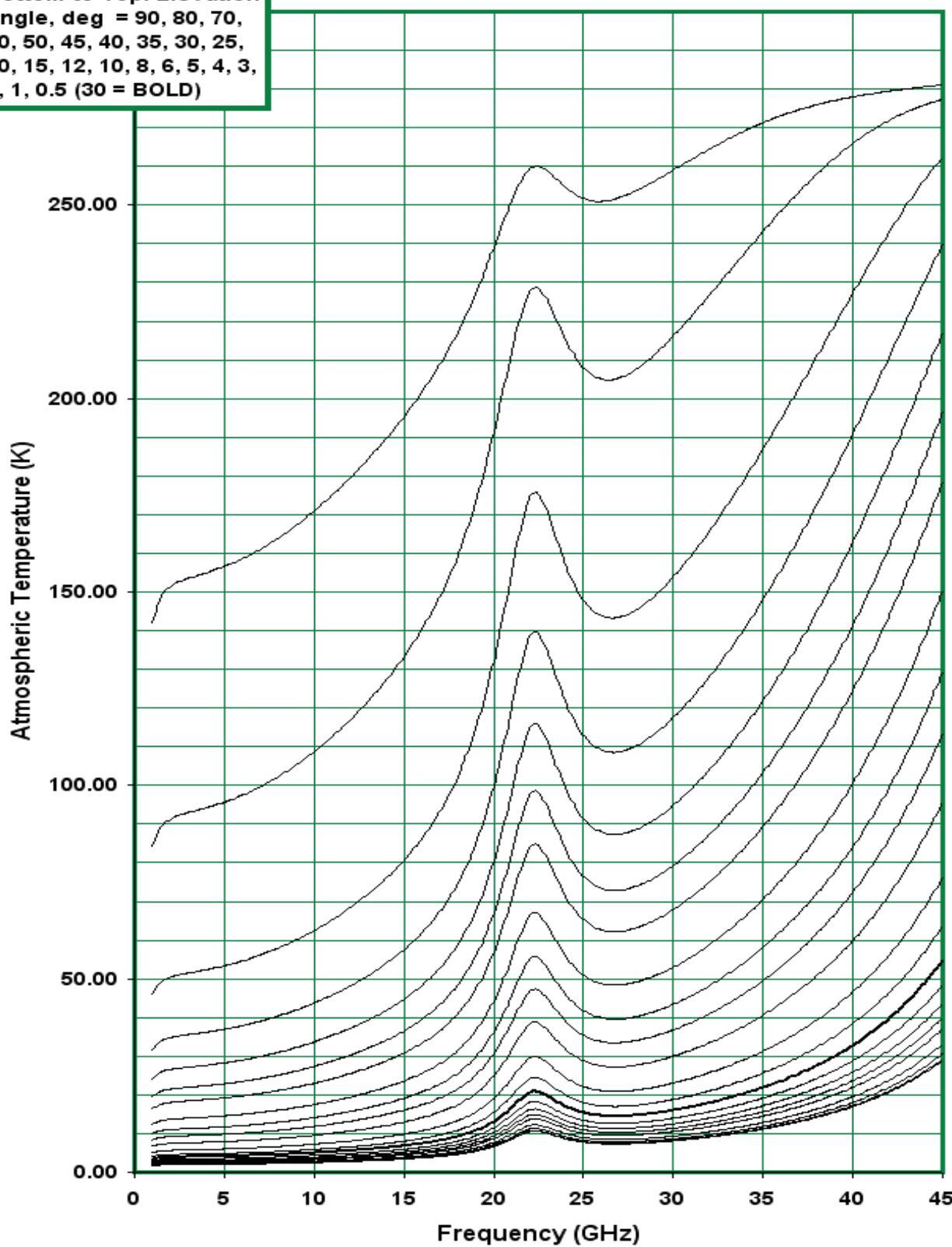
Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

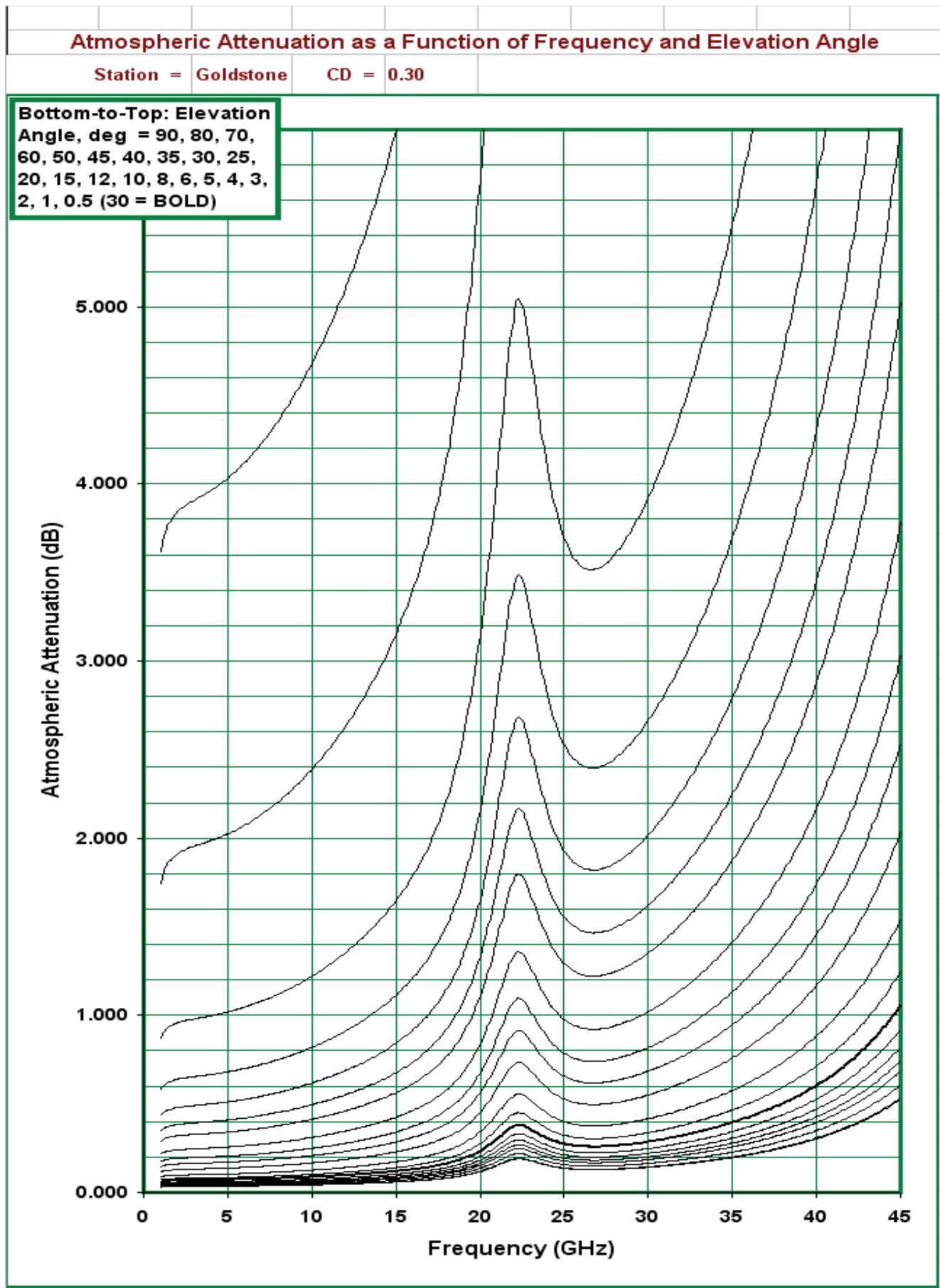
Station = Goldstone

CD = 0.25

as a Function of Frequency and Elevation Angle

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)





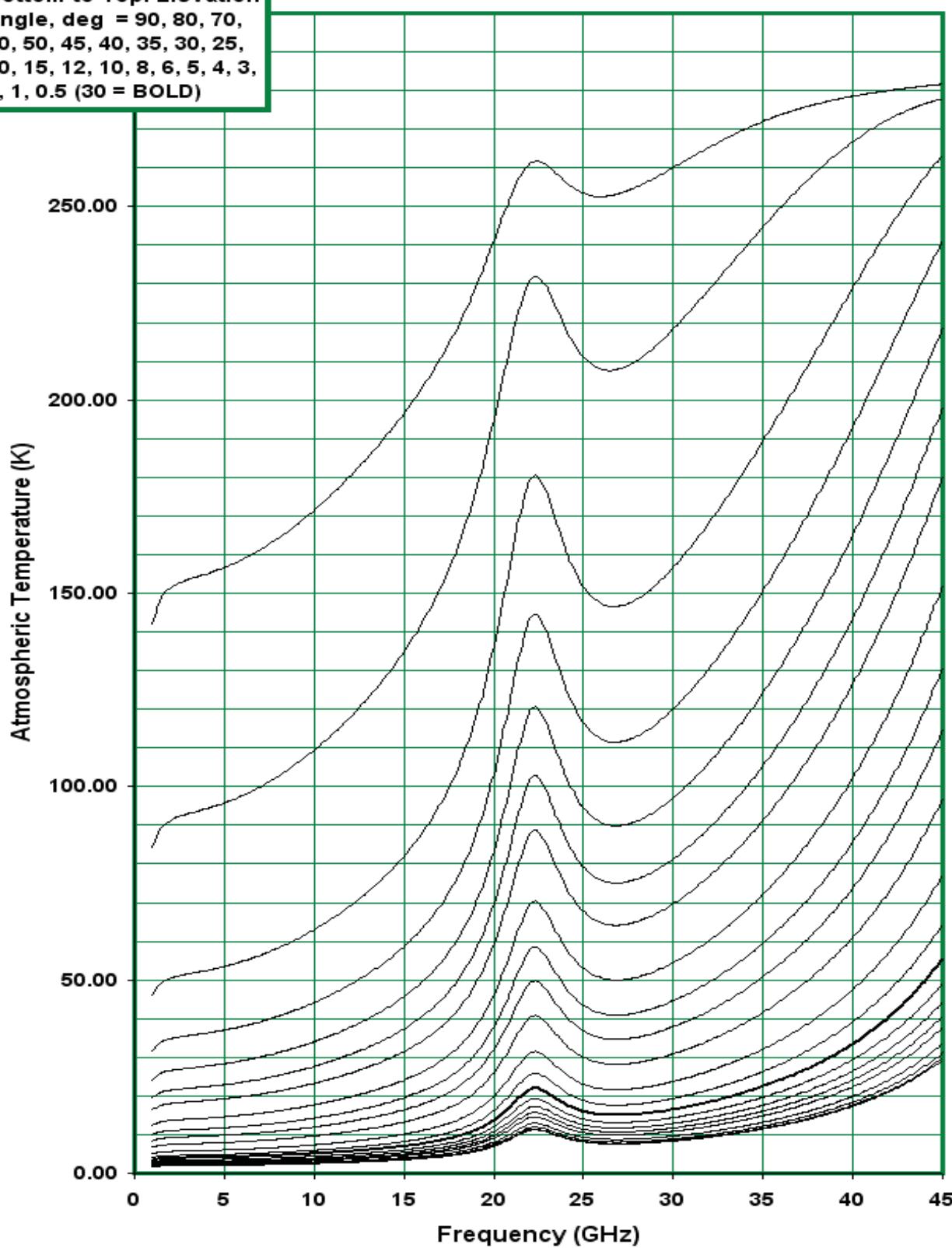
Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

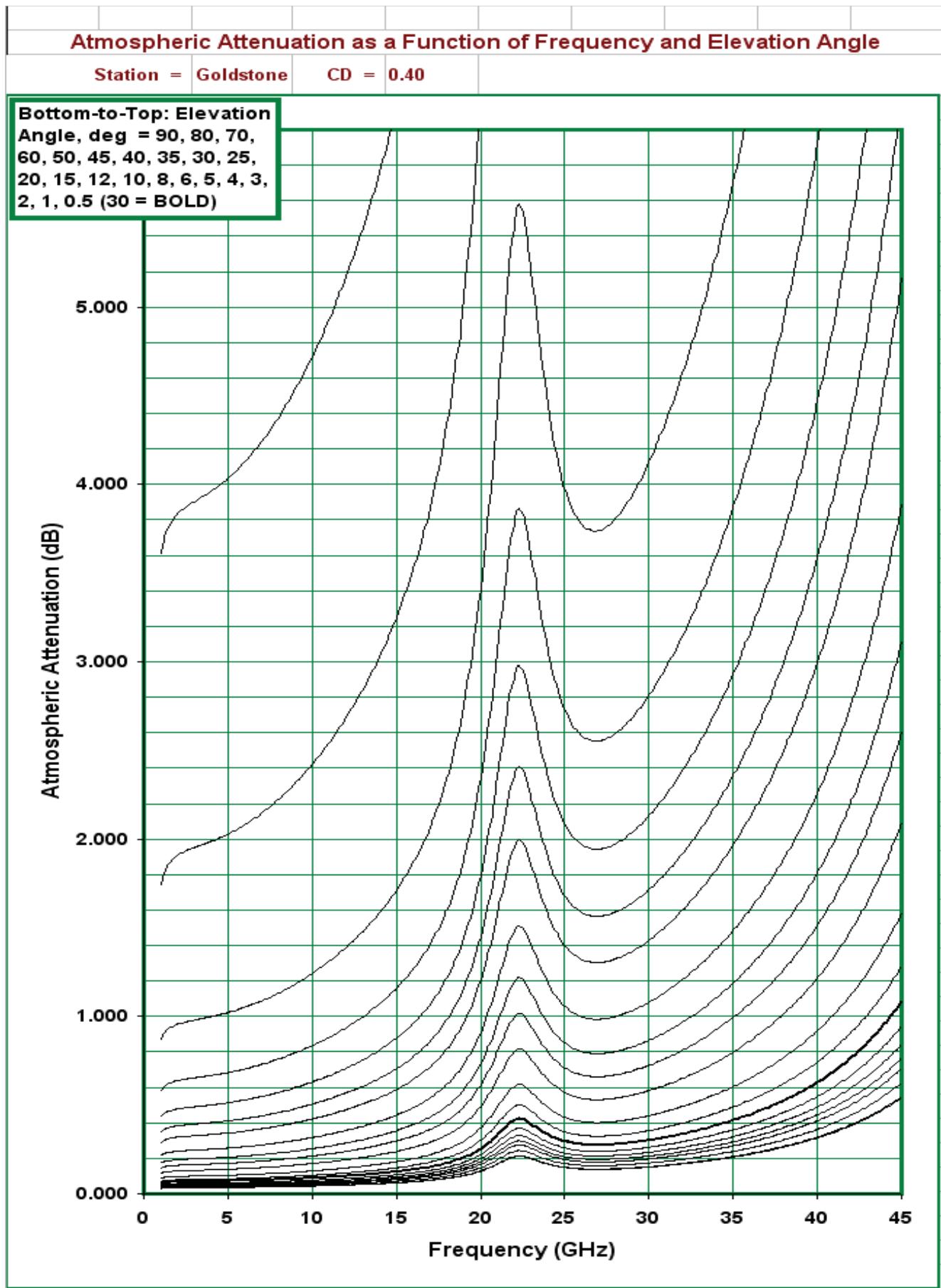
Station = Goldstone

CD = 0.30

as a Function of Frequency and Elevation Angle

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)





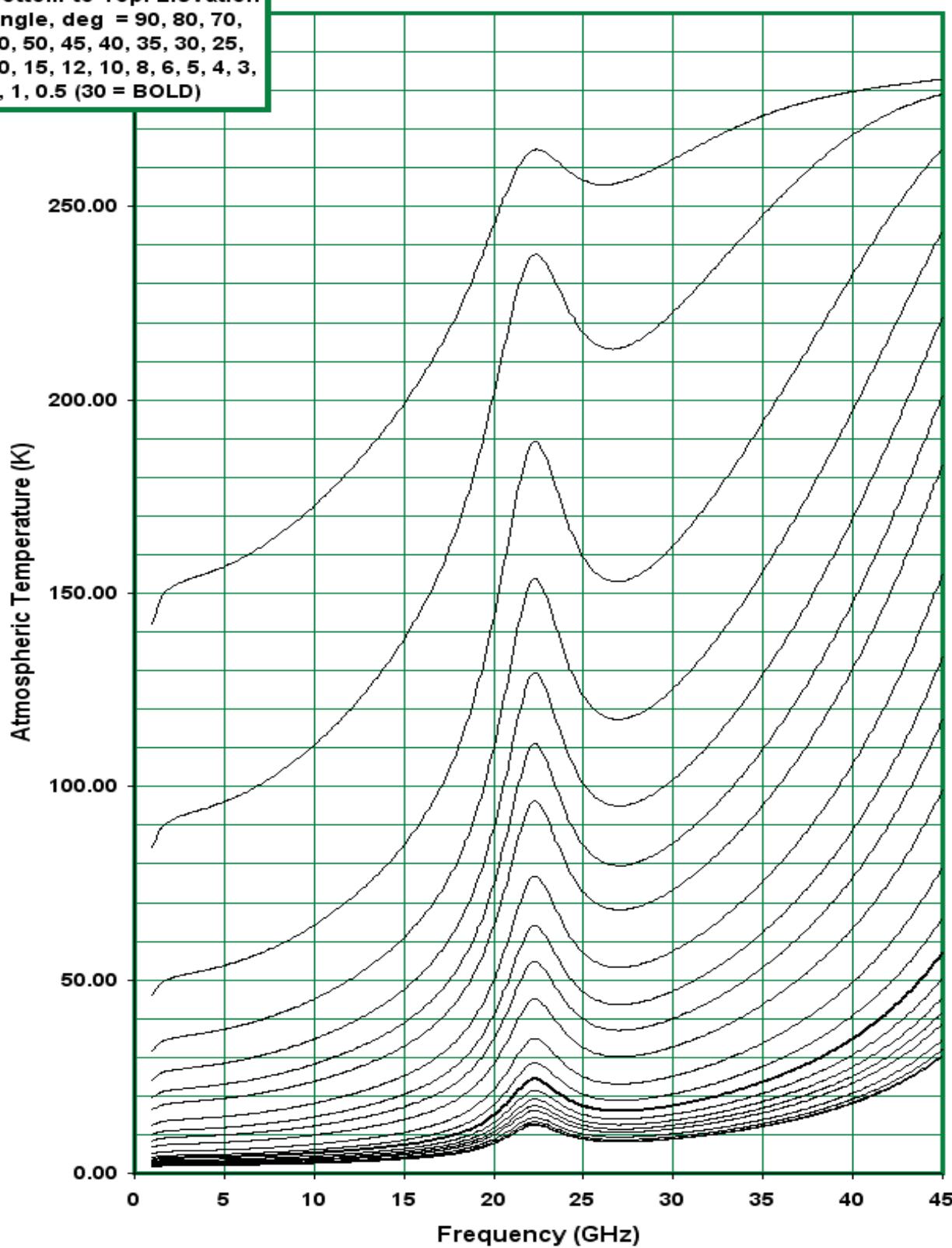
Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

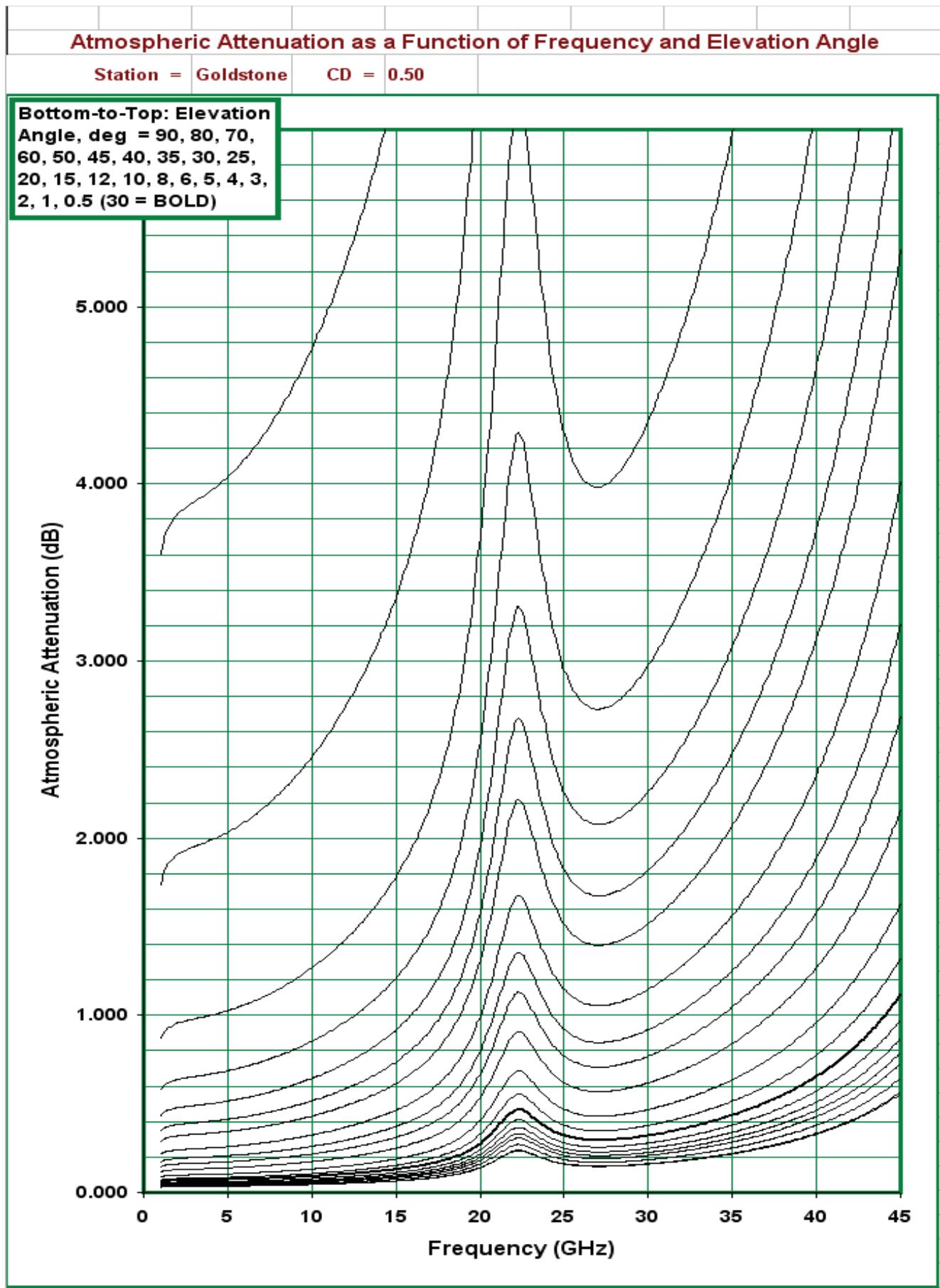
Station = Goldstone

CD = 0.40

as a Function of Frequency and Elevation Angle

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)





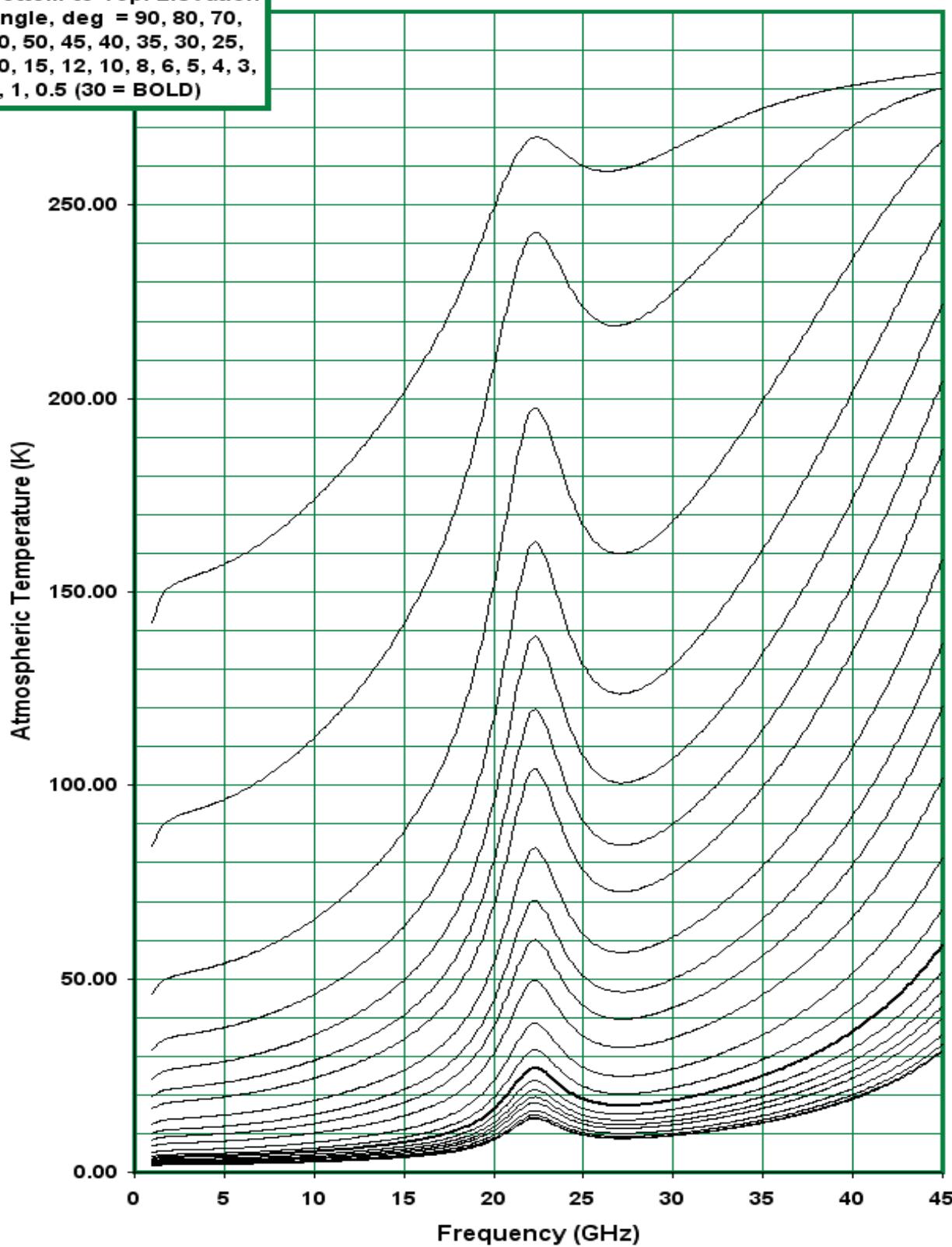
Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

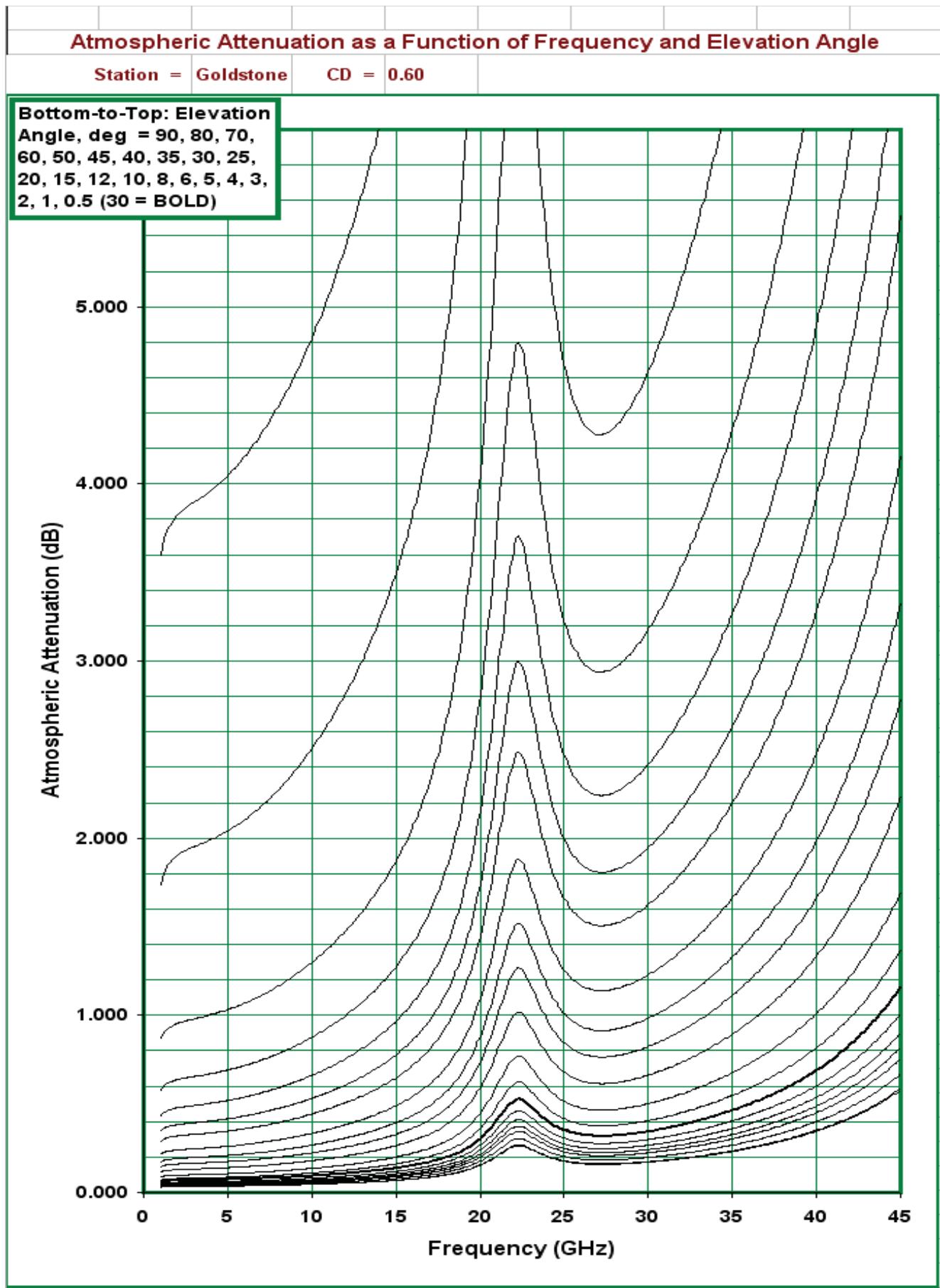
Station = Goldstone

CD = 0.50

as a Function of Frequency and Elevation Angle

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)





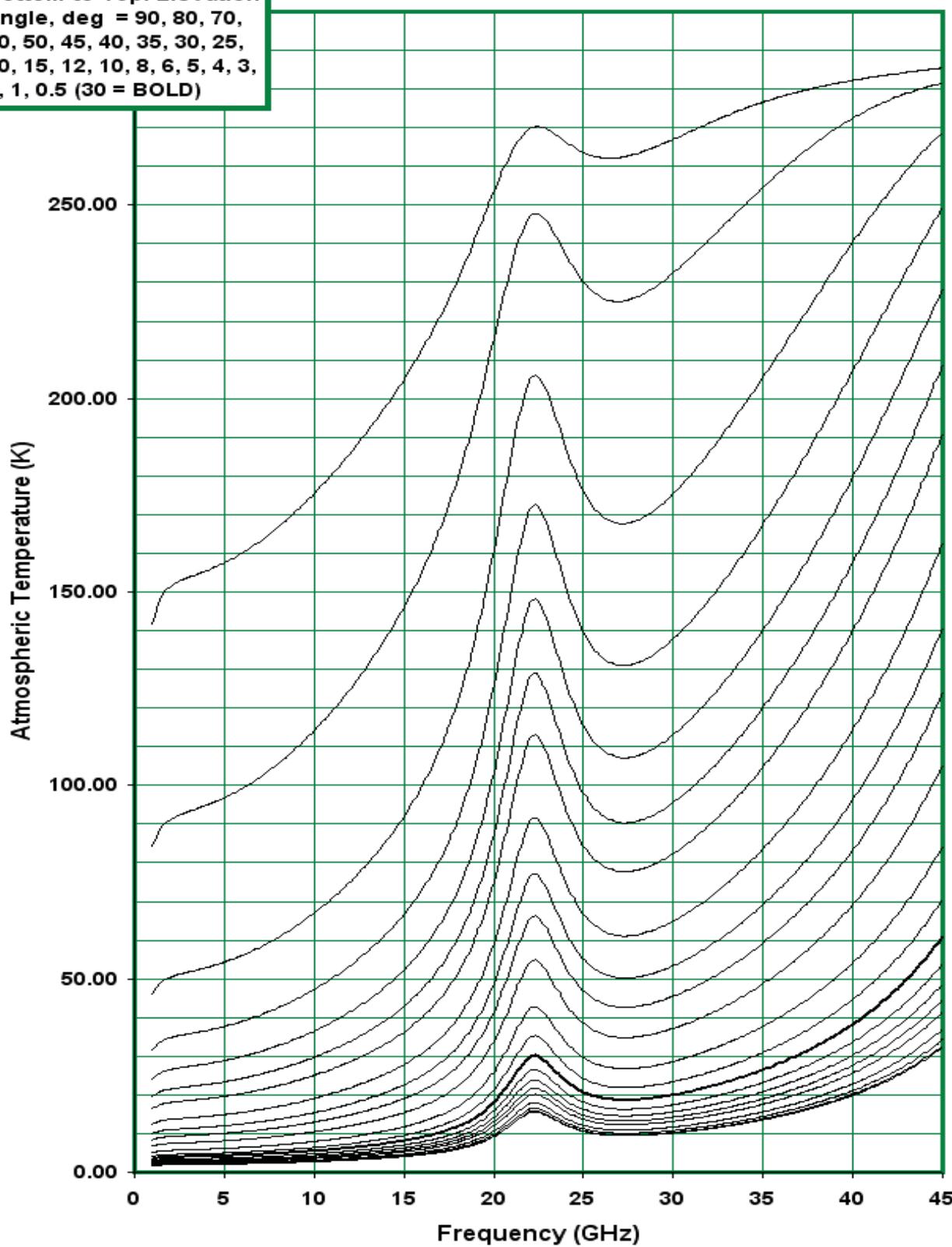
Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

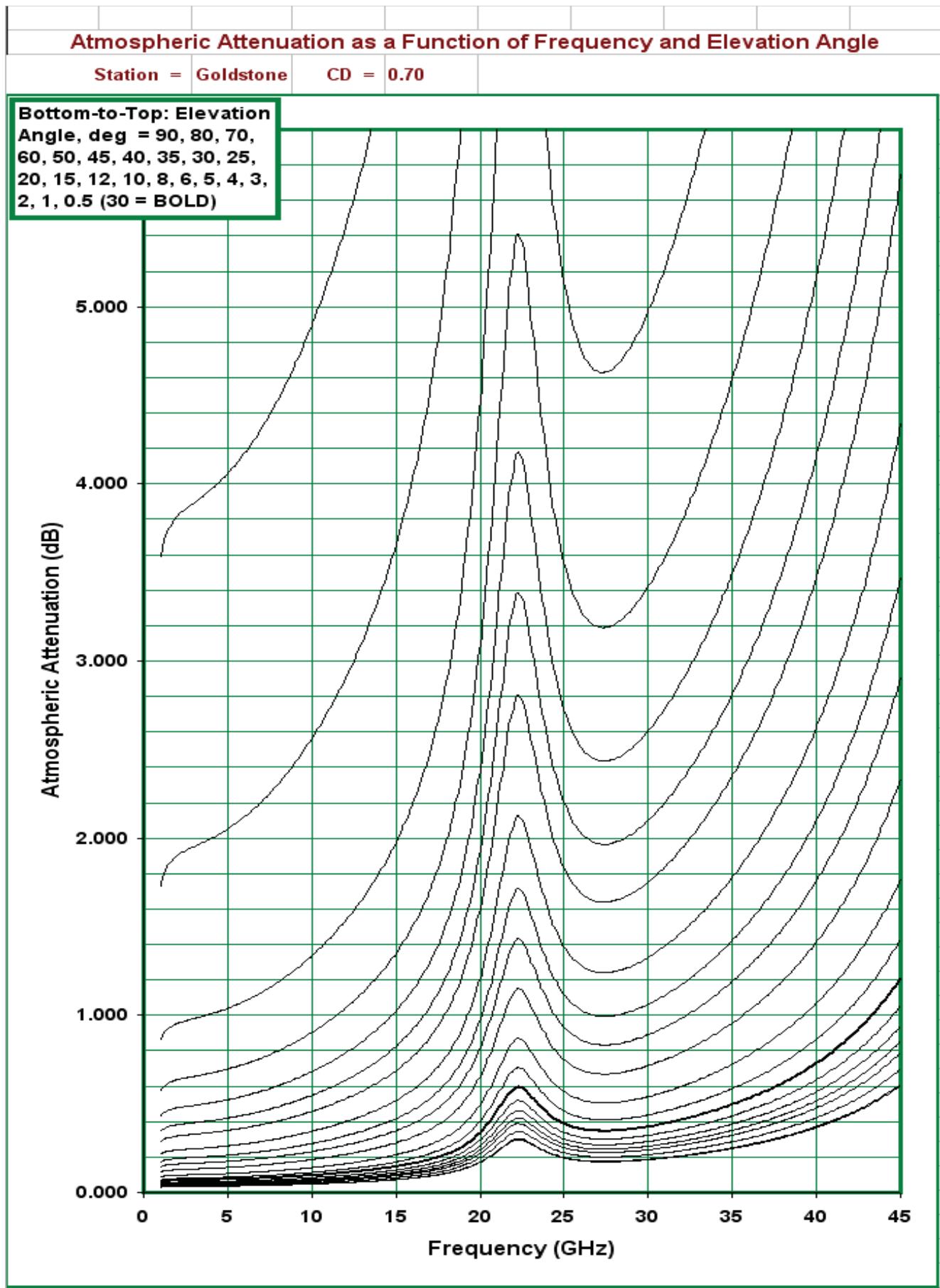
Station = Goldstone

CD = 0.60

as a Function of Frequency and Elevation Angle

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)





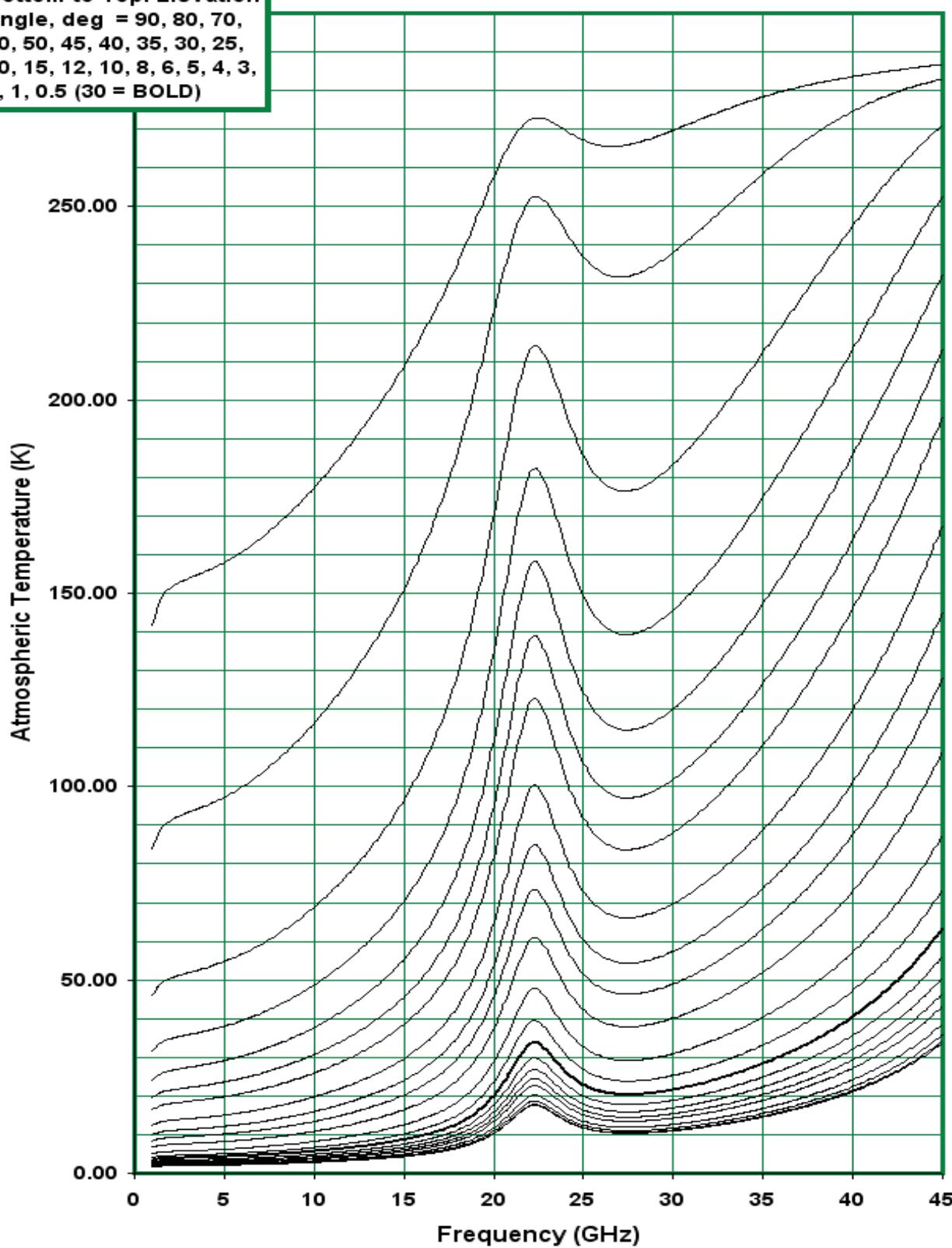
Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

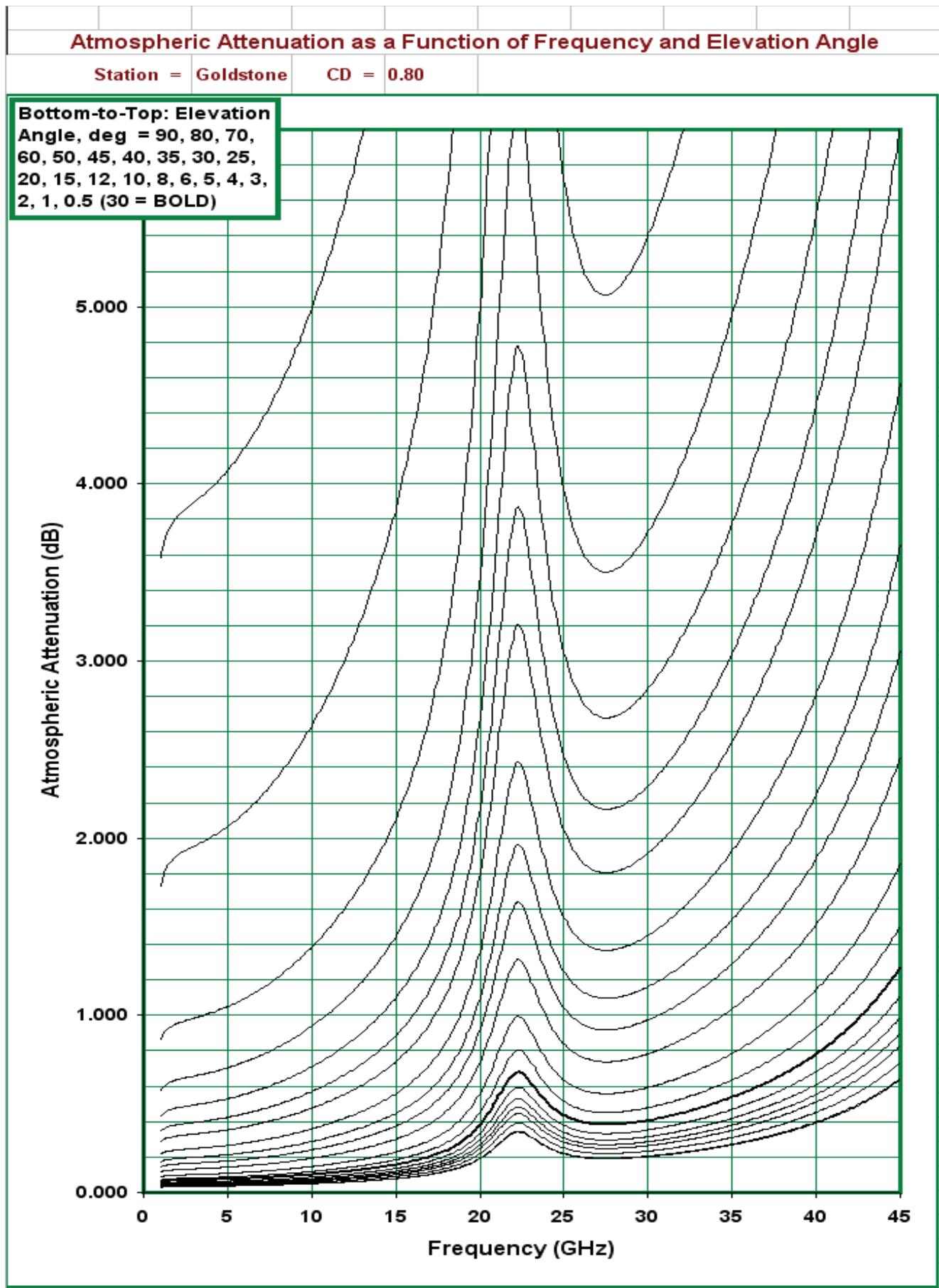
Station = Goldstone

CD = 0.70

as a Function of Frequency and Elevation Angle

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)





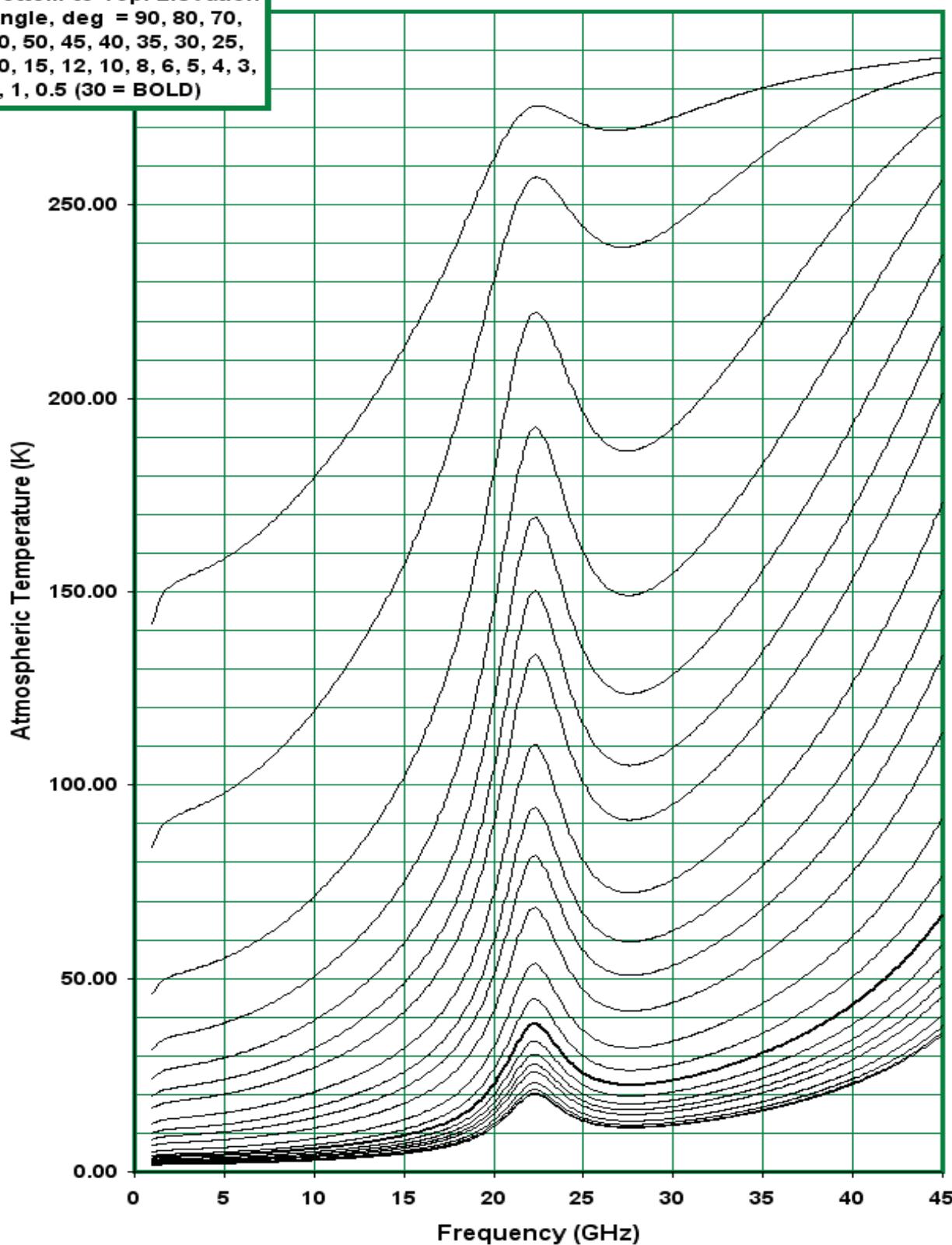
Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

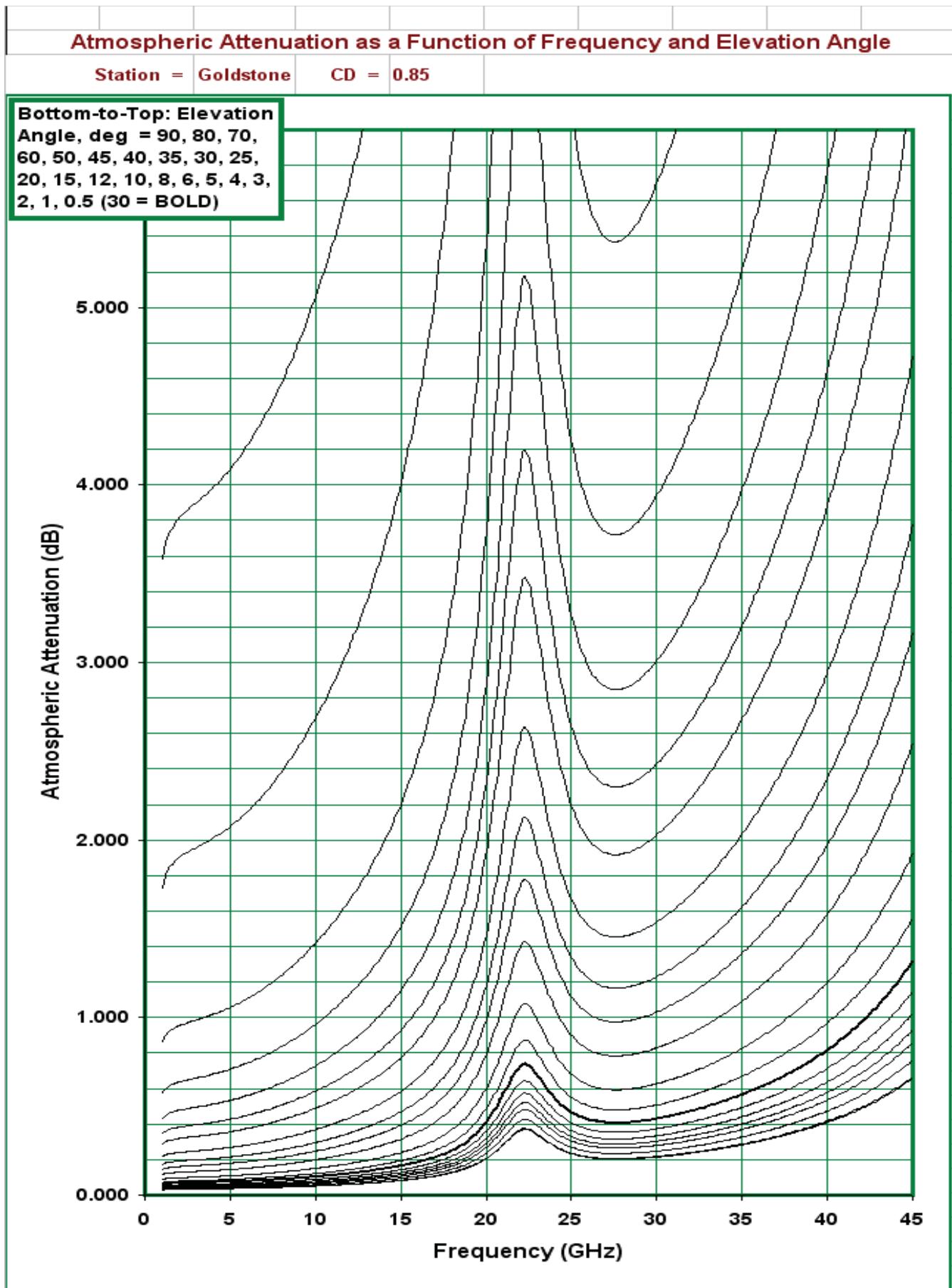
Station = Goldstone

CD = 0.80

as a Function of Frequency and Elevation Angle

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)





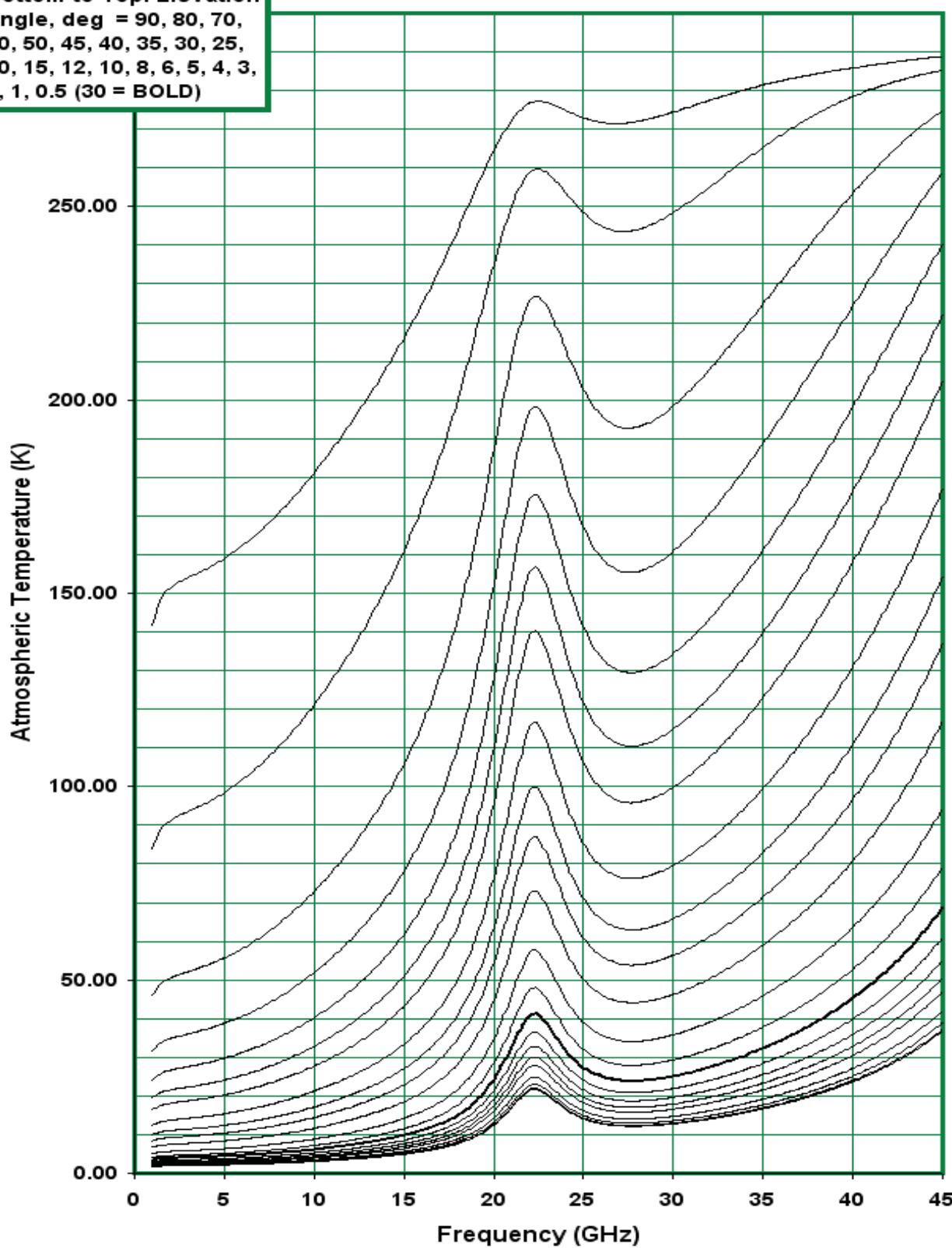
Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

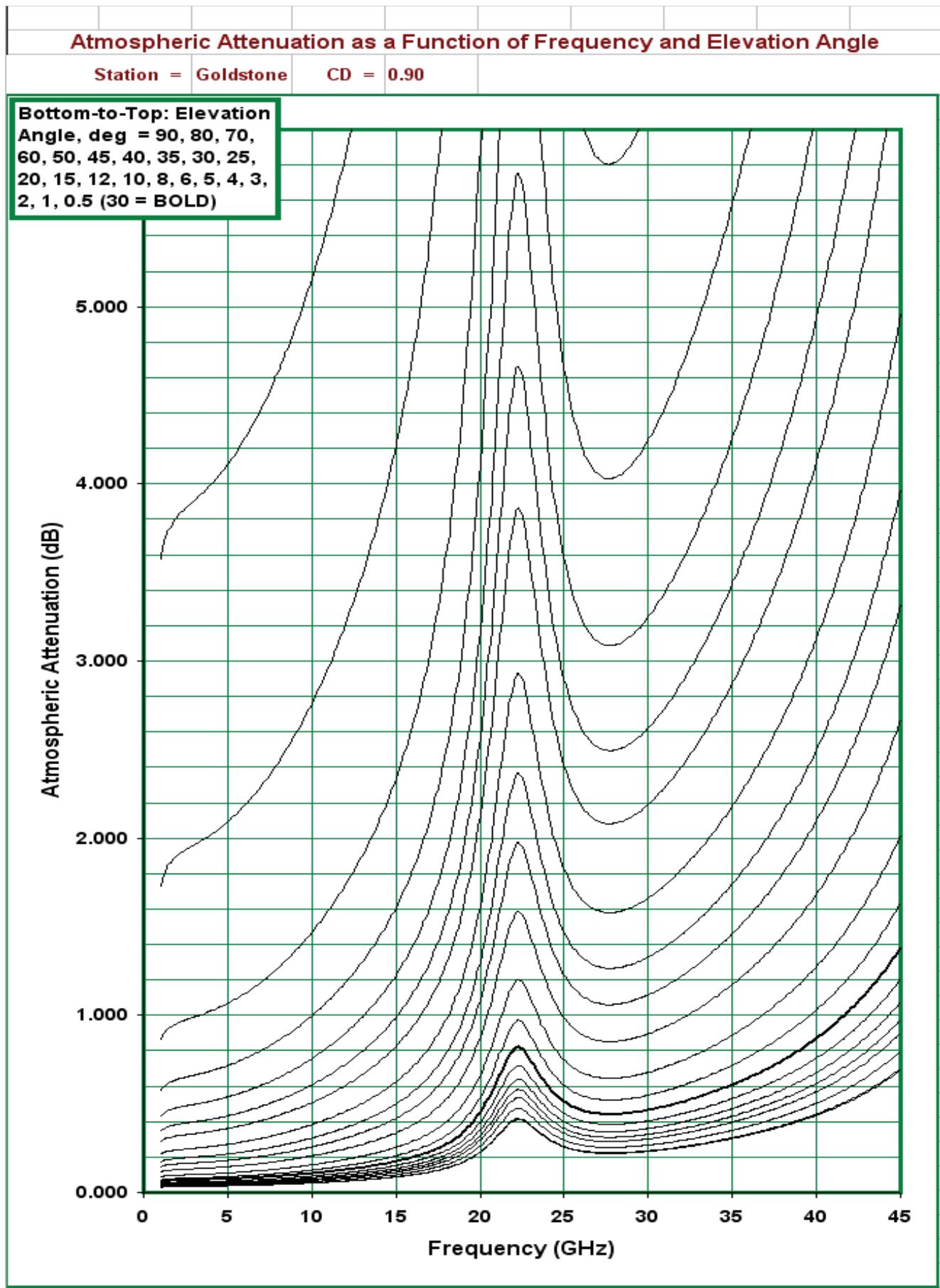
Station = Goldstone

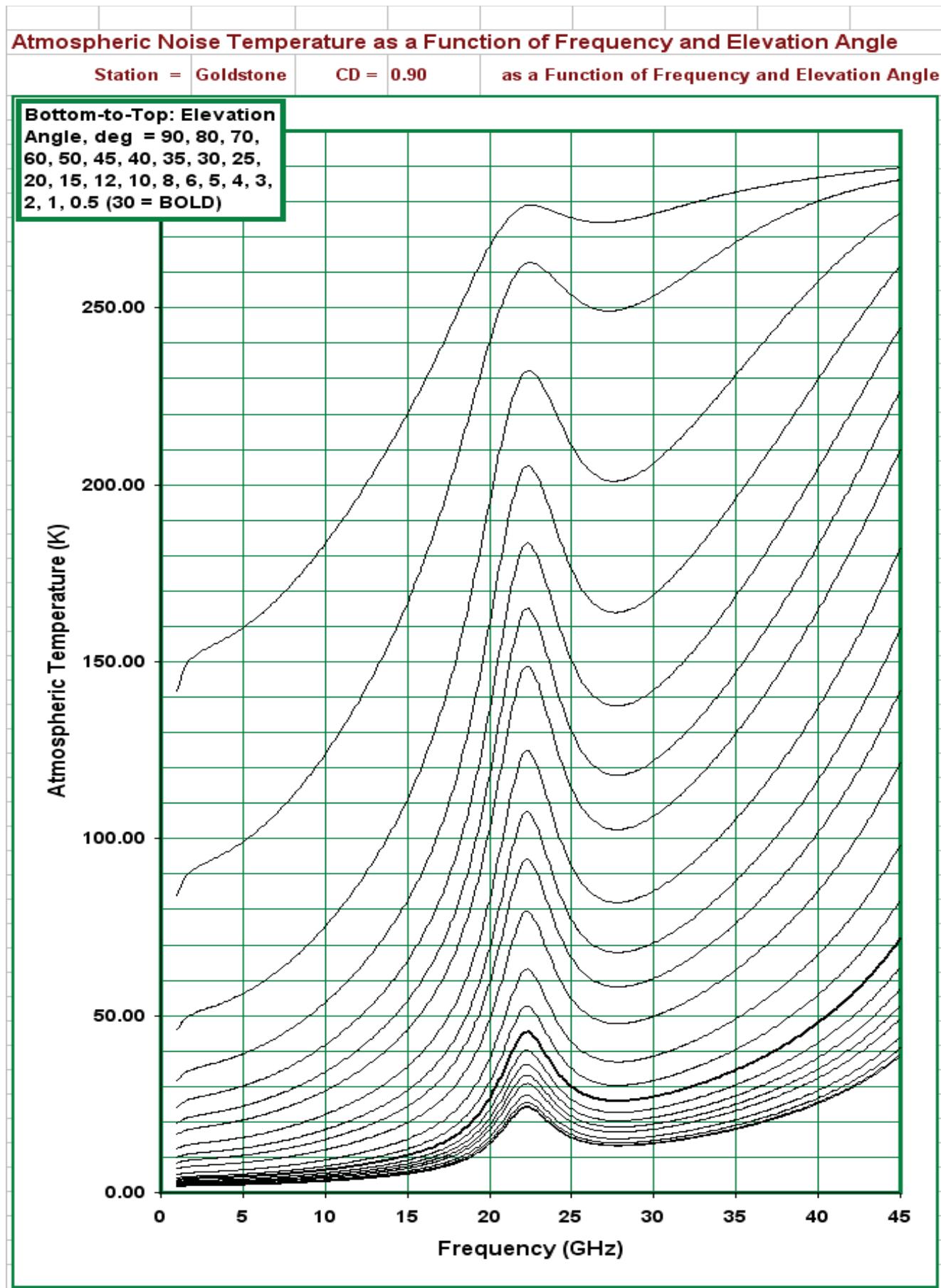
CD = 0.85

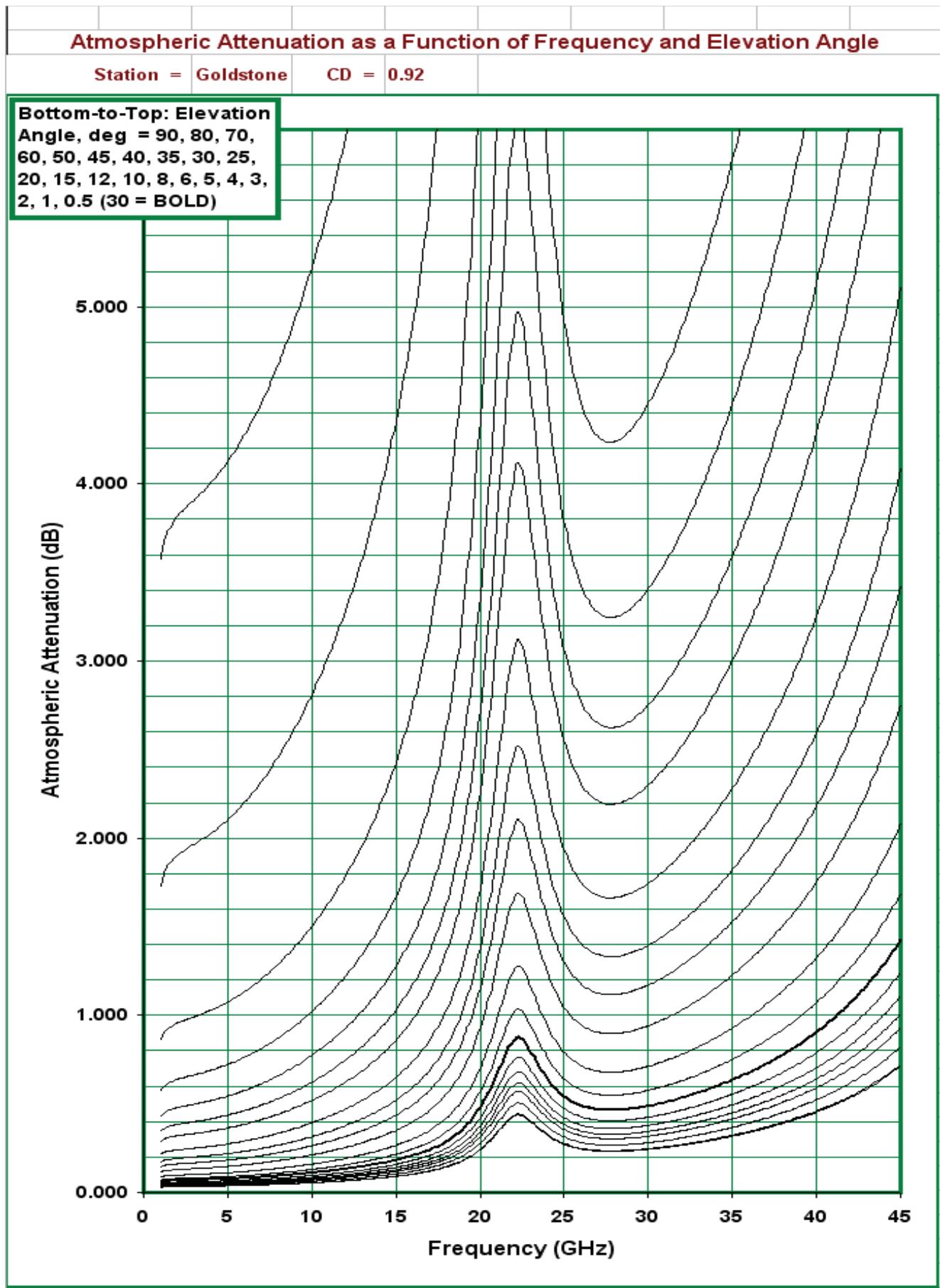
as a Function of Frequency and Elevation Angle

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)









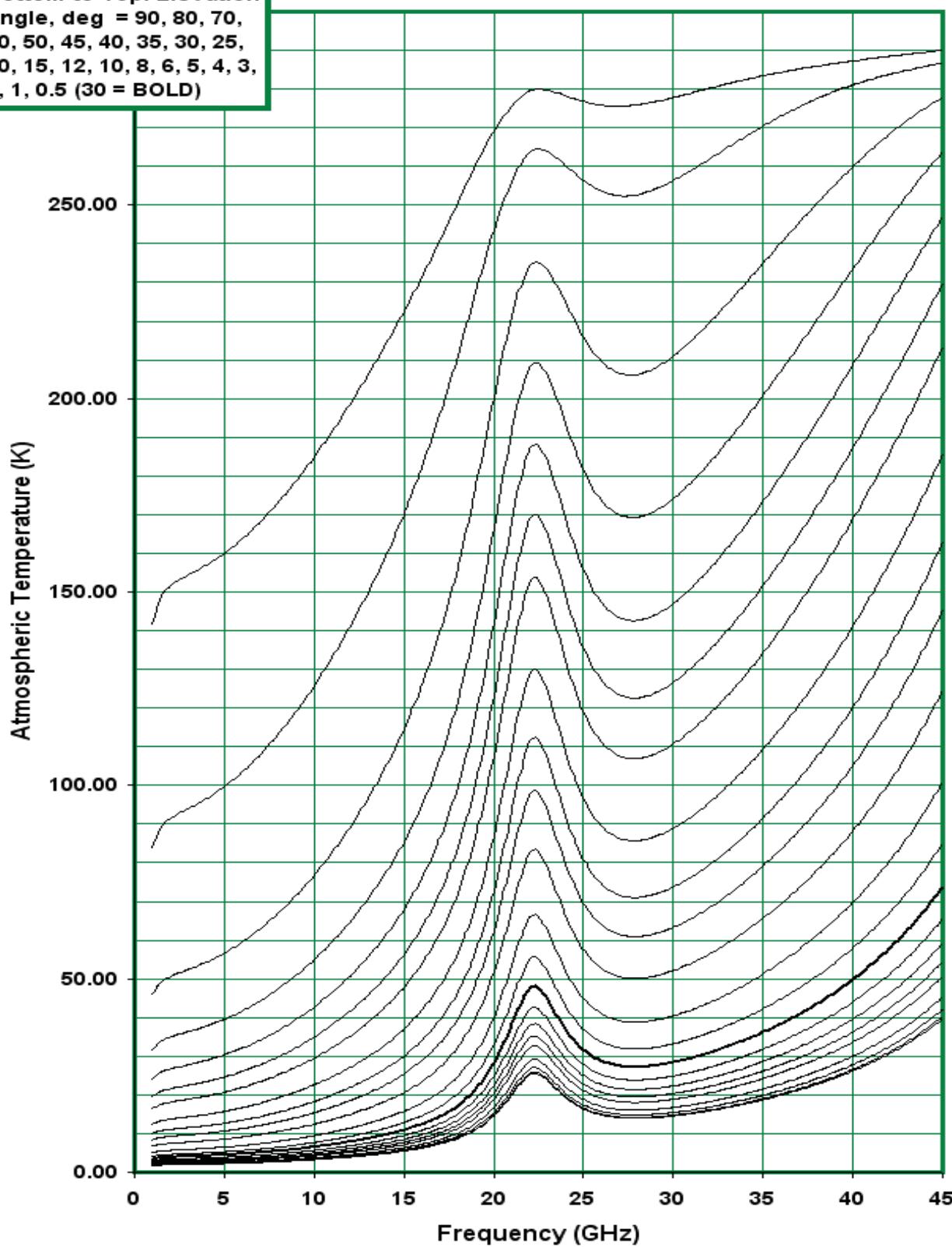
Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

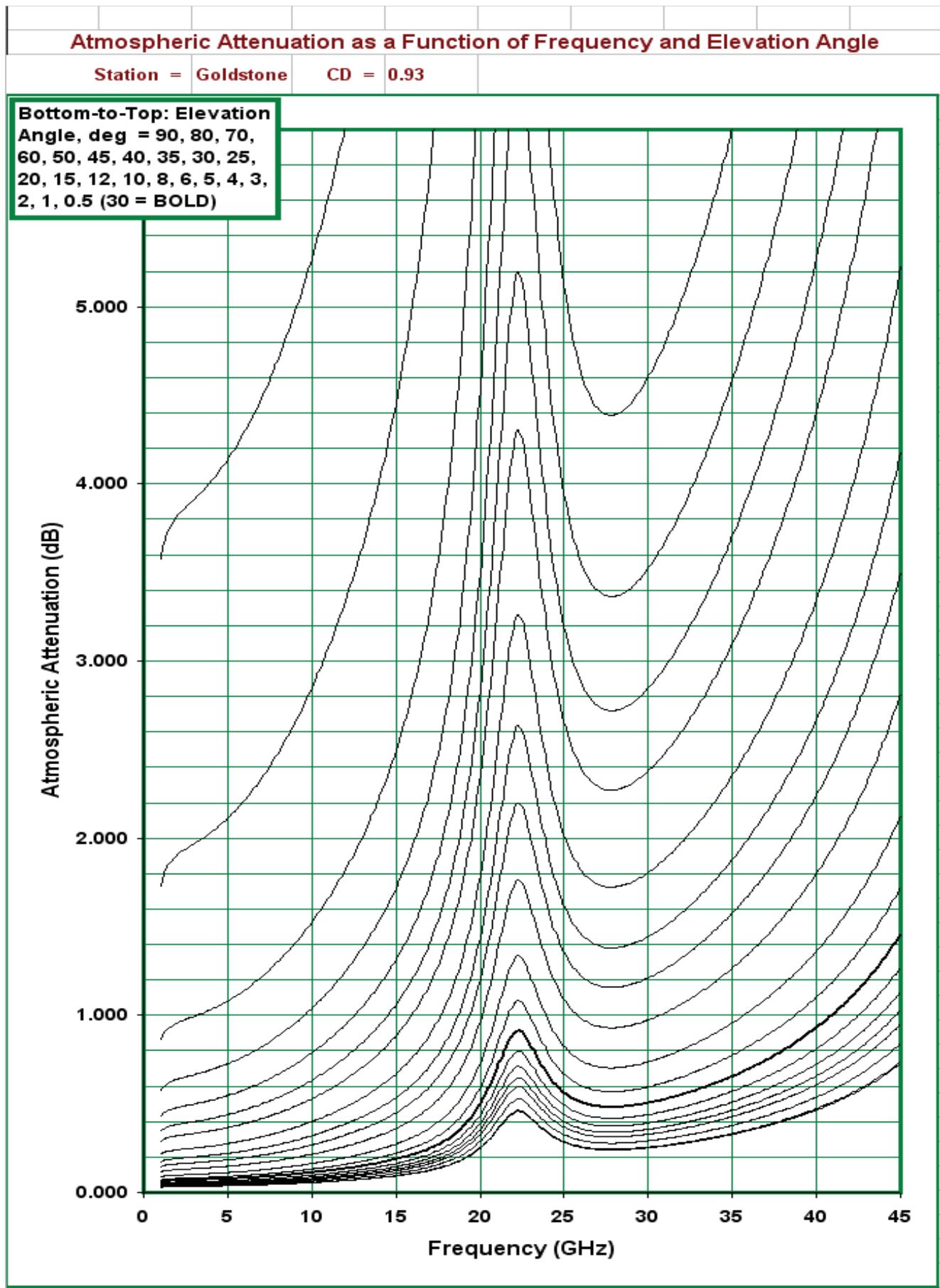
Station = Goldstone

CD = 0.92

as a Function of Frequency and Elevation Angle

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)





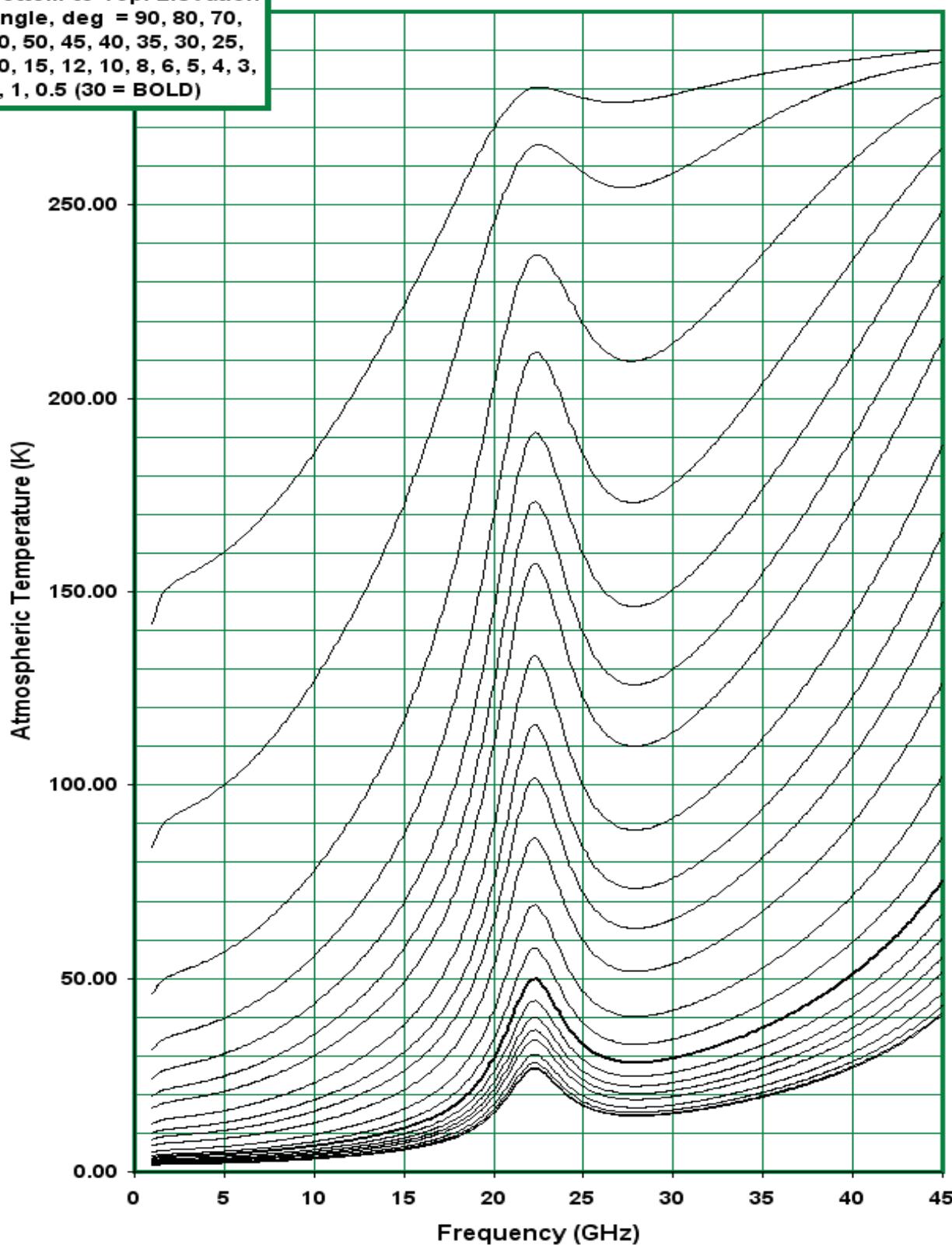
Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

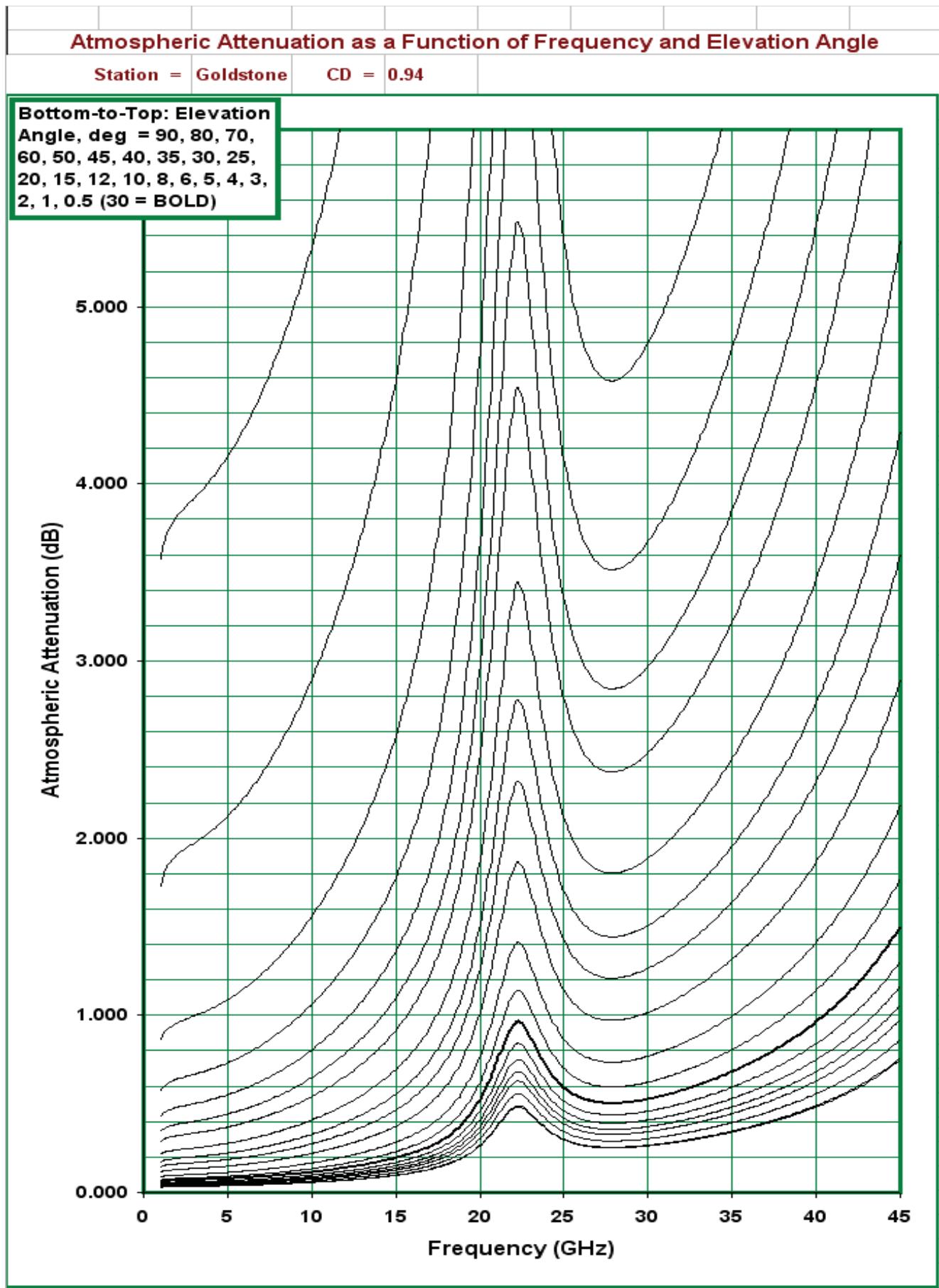
Station = Goldstone

CD = 0.93

as a Function of Frequency and Elevation Angle

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)





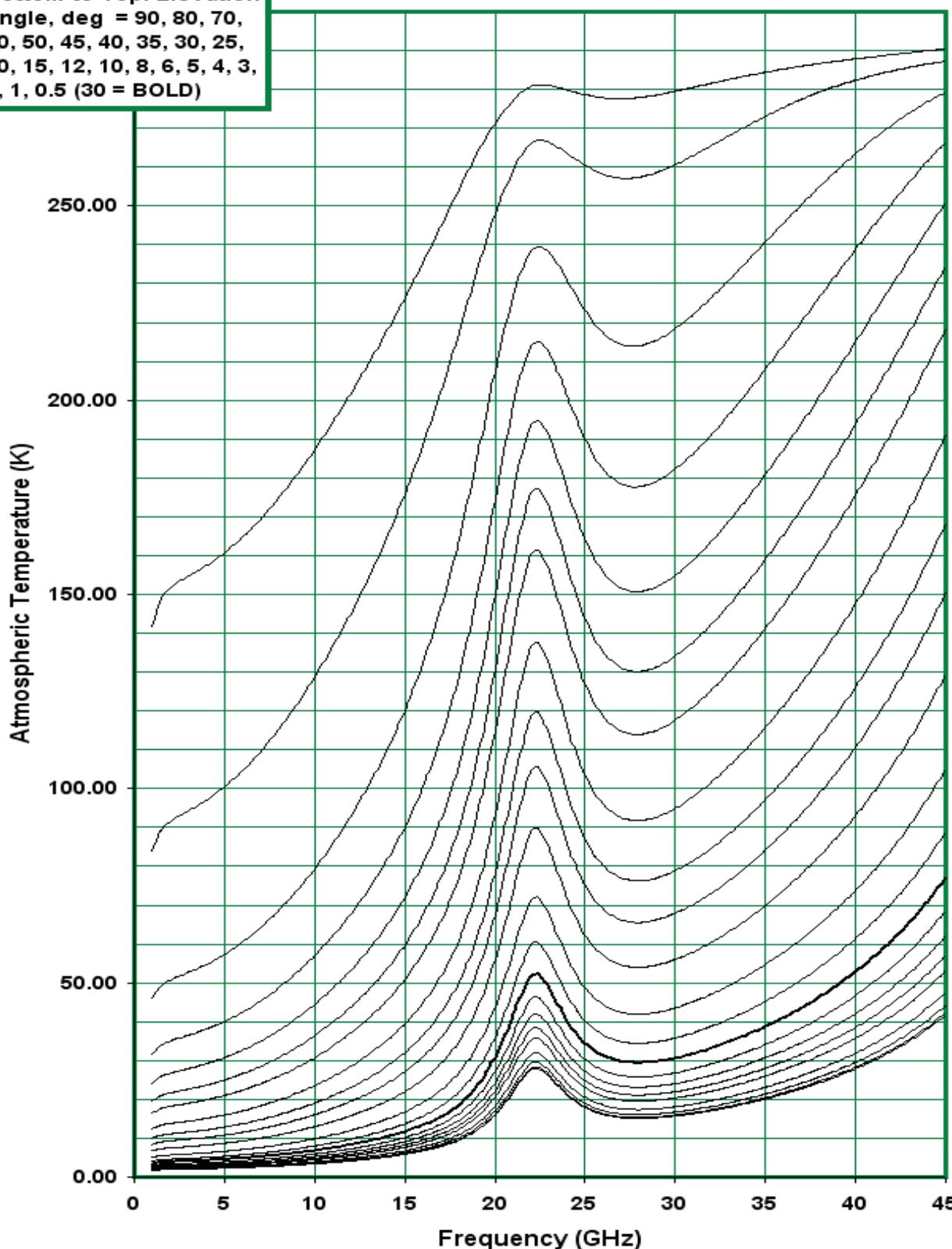
Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

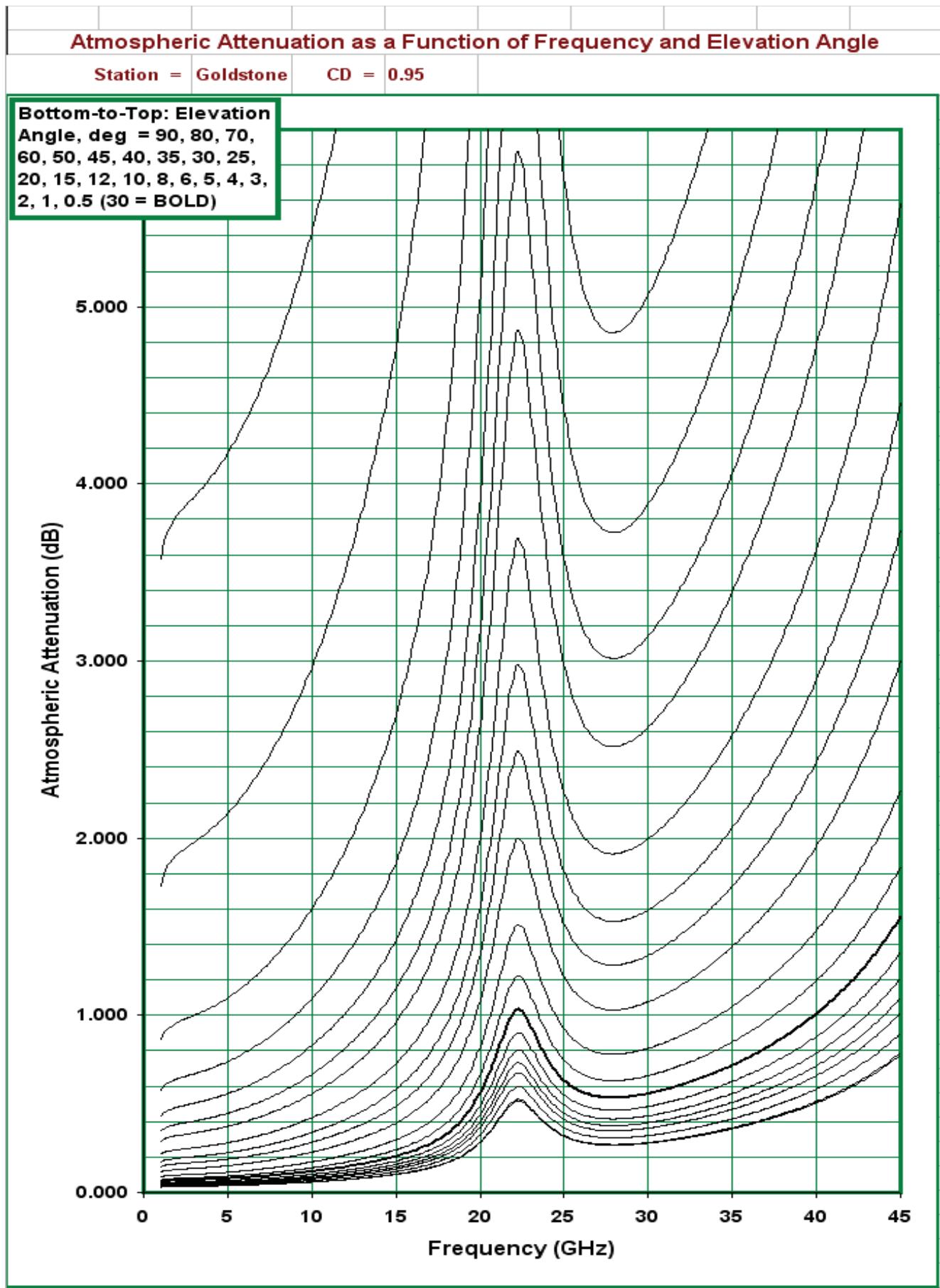
Station = Goldstone

CD = 0.94

as a Function of Frequency and Elevation Angle

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)





Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

Station = Goldstone

CD = 0.95

as a Function of Frequency and Elevation Angle

Bottom-to-Top: Elevation

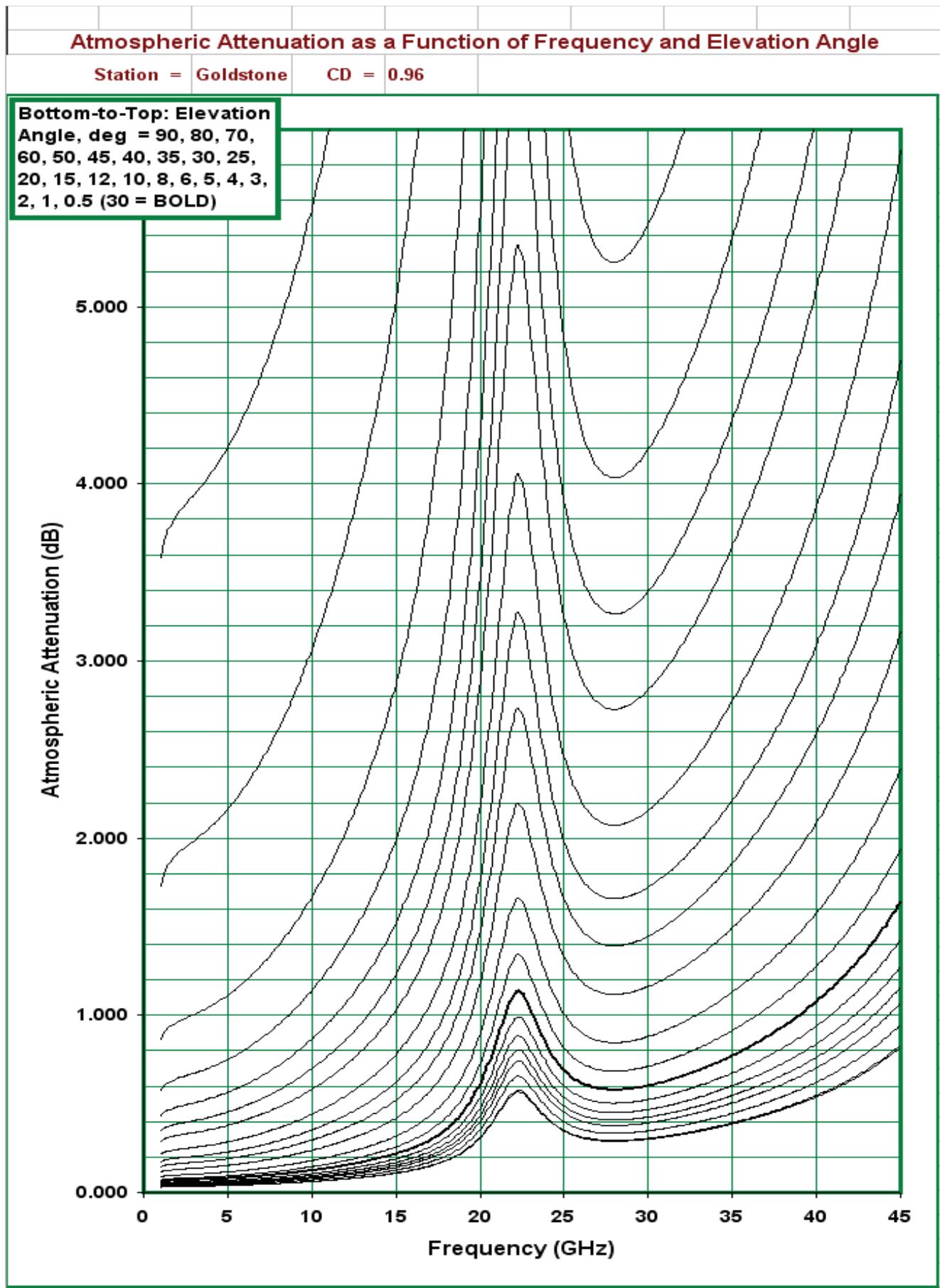
Angle, deg = 90, 80, 70,
60, 50, 45, 40, 35, 30, 25,
20, 15, 12, 10, 8, 6, 5, 4, 3,
2, 1, 0.5 (30 = BOLD)

Atmospheric Temperature (K)

250.00
200.00
150.00
100.00
50.00
0.00

0 5 10 15 20 25 30 35 40 45

Frequency (GHz)



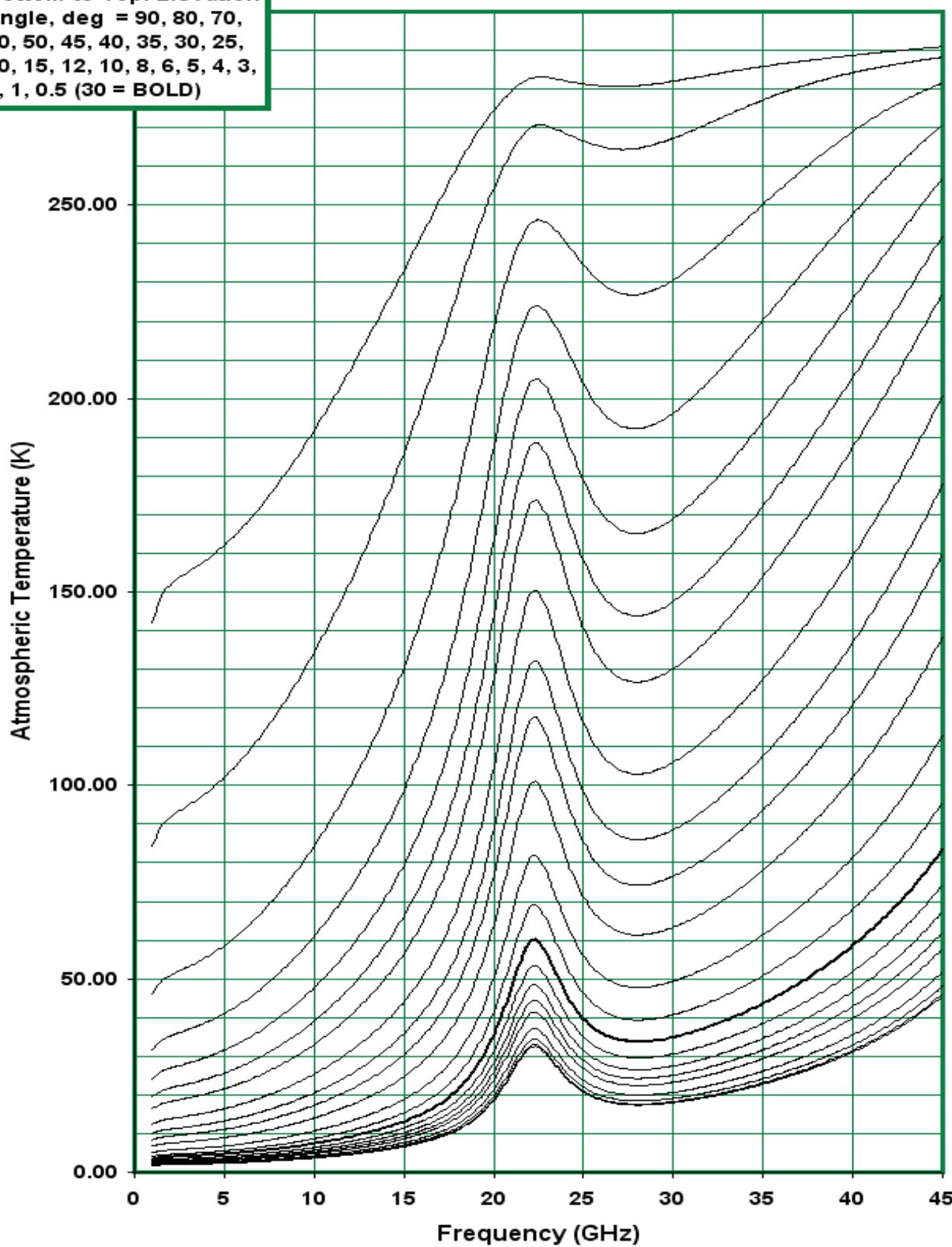
Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

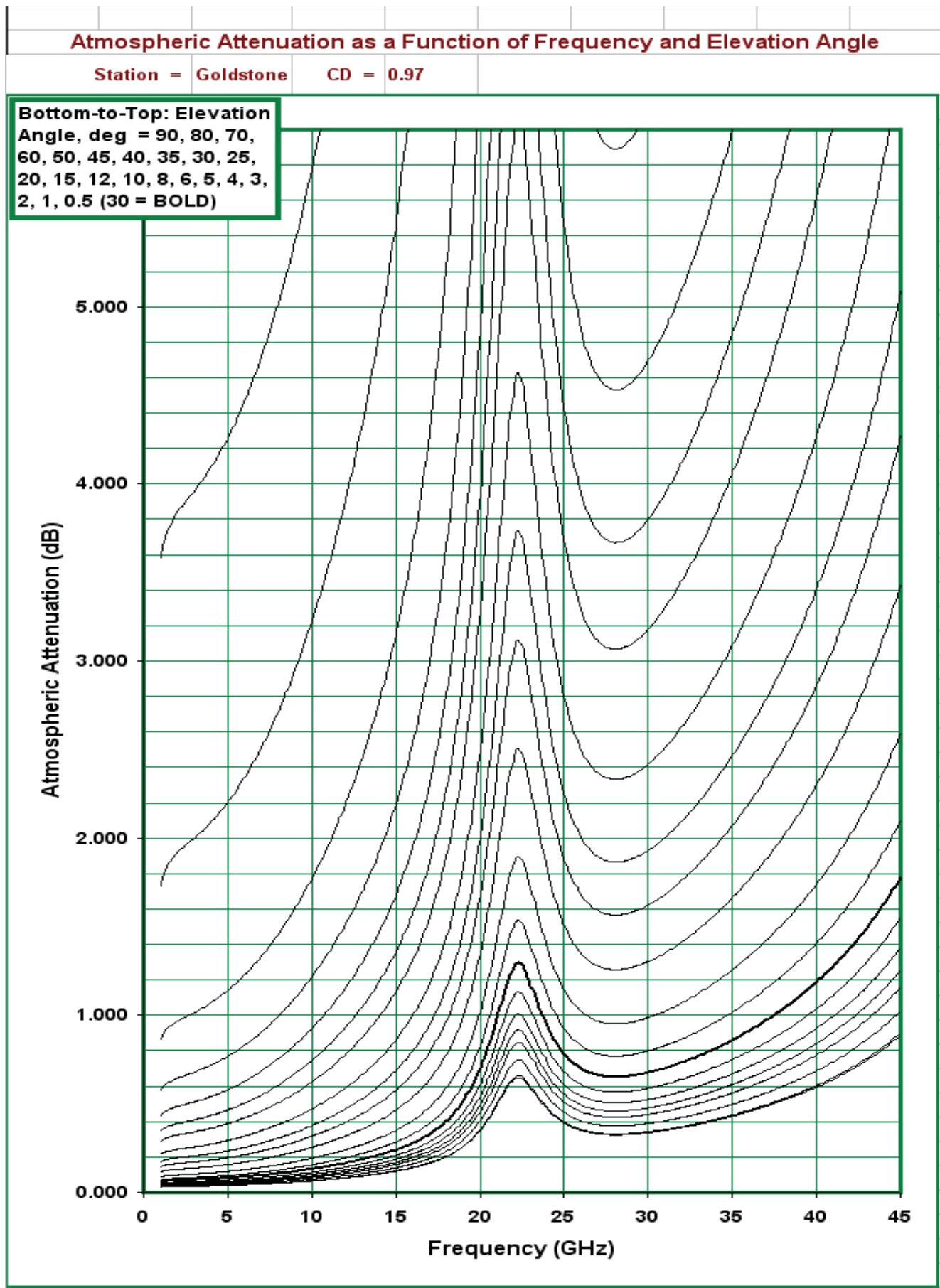
Station = Goldstone

CD = 0.96

as a Function of Frequency and Elevation Angle

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)





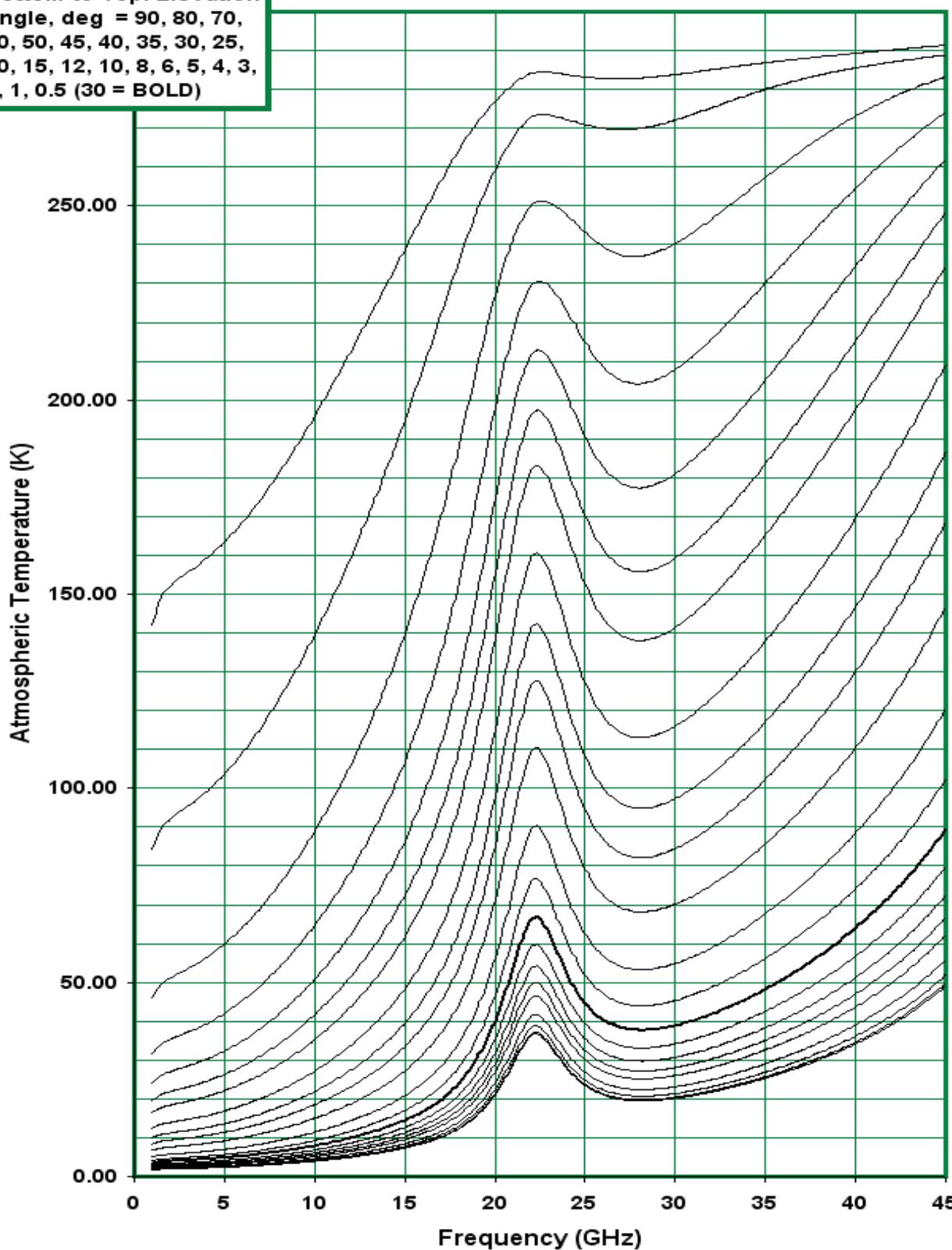
Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

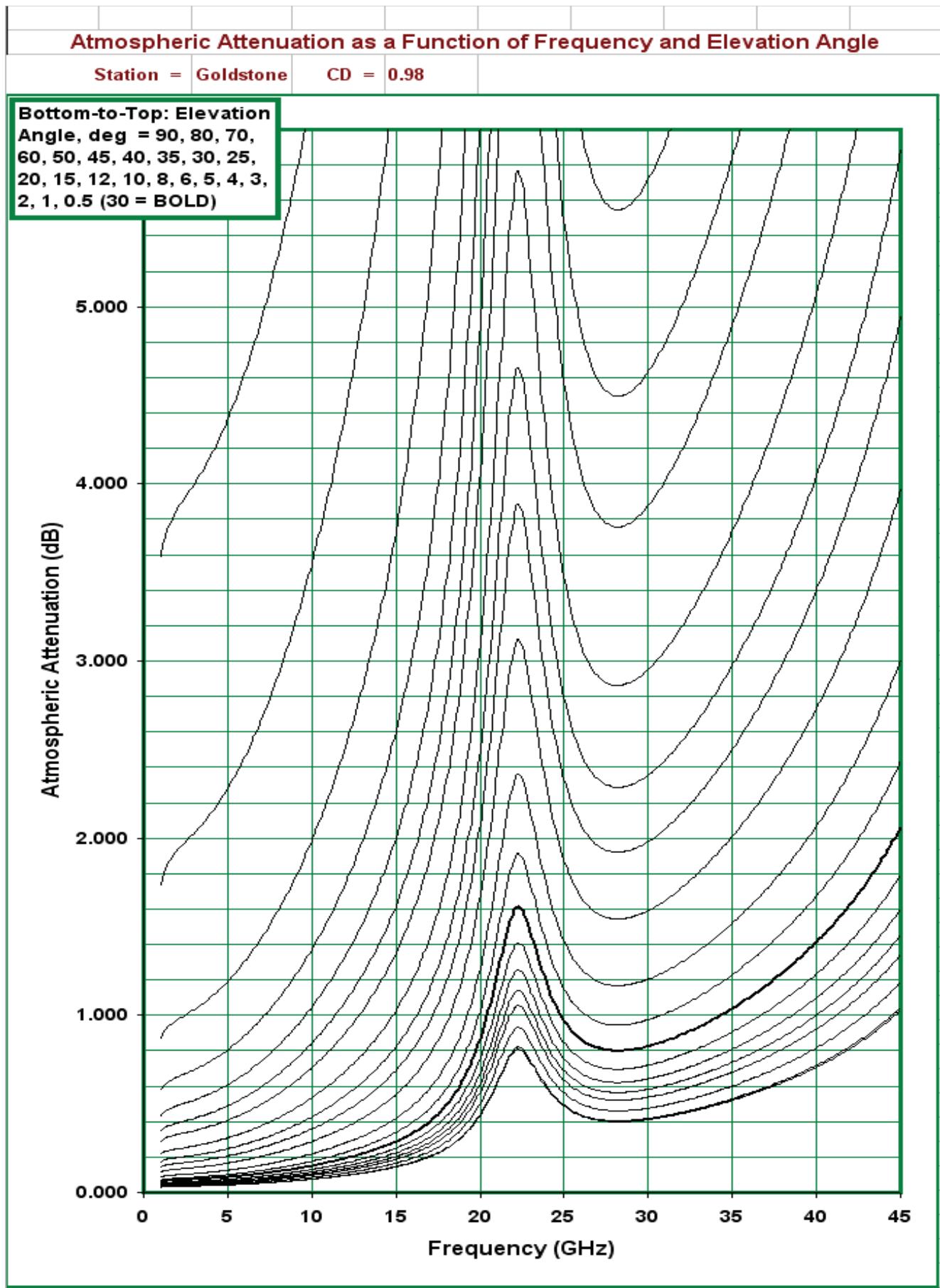
Station = Goldstone

CD = 0.97

as a Function of Frequency and Elevation Angle

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)





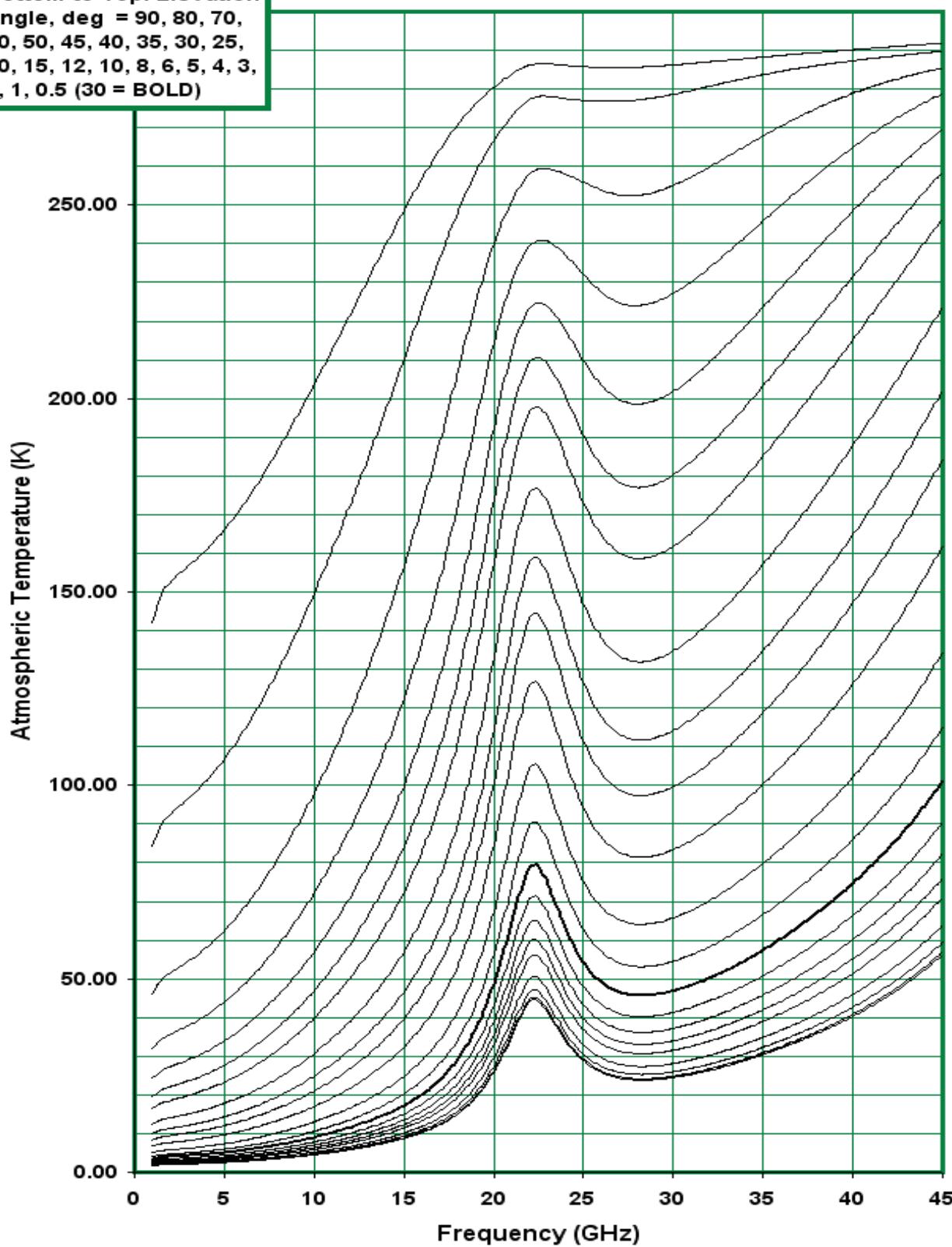
Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

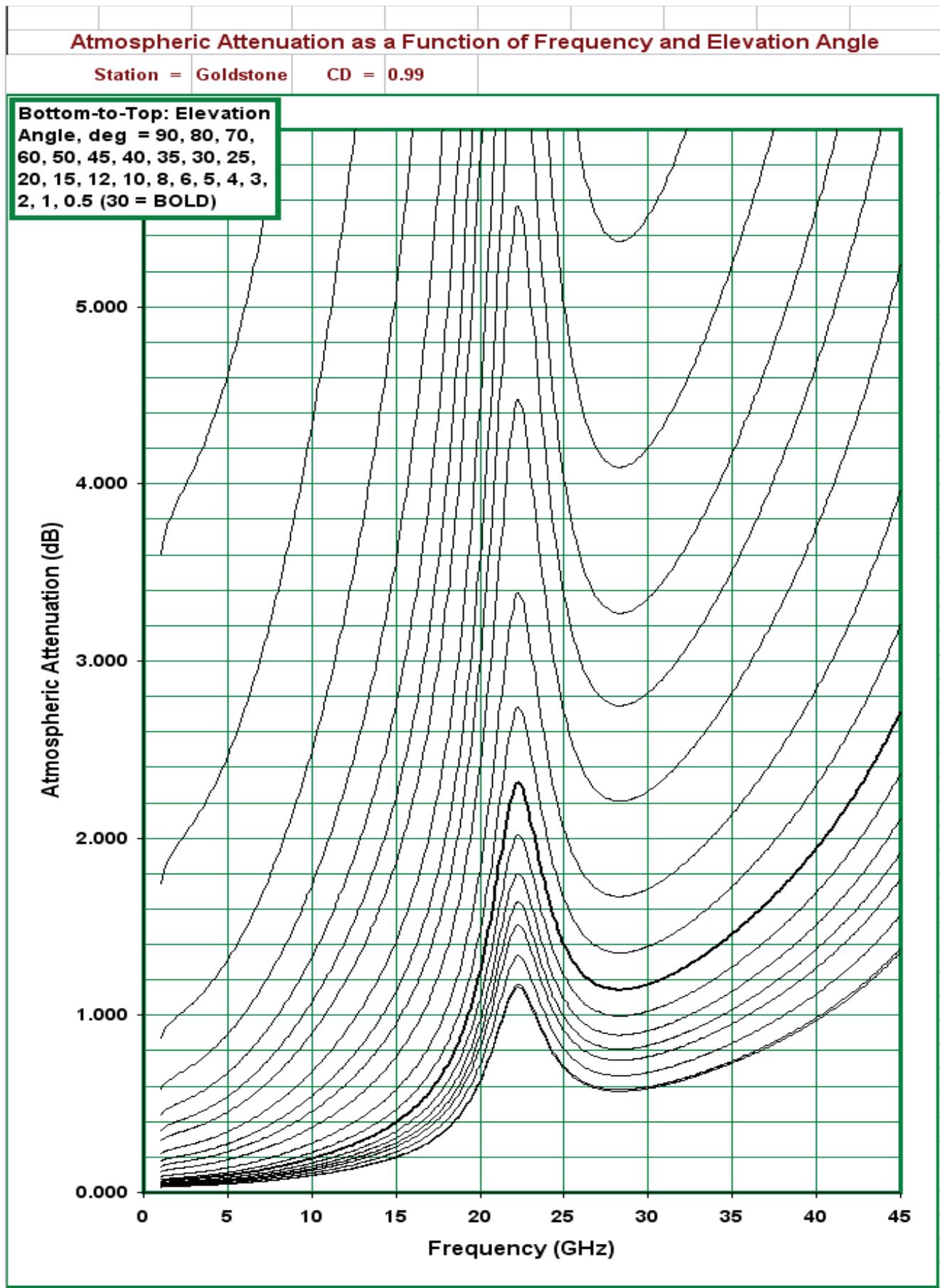
Station = Goldstone

CD = 0.98

as a Function of Frequency and Elevation Angle

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)





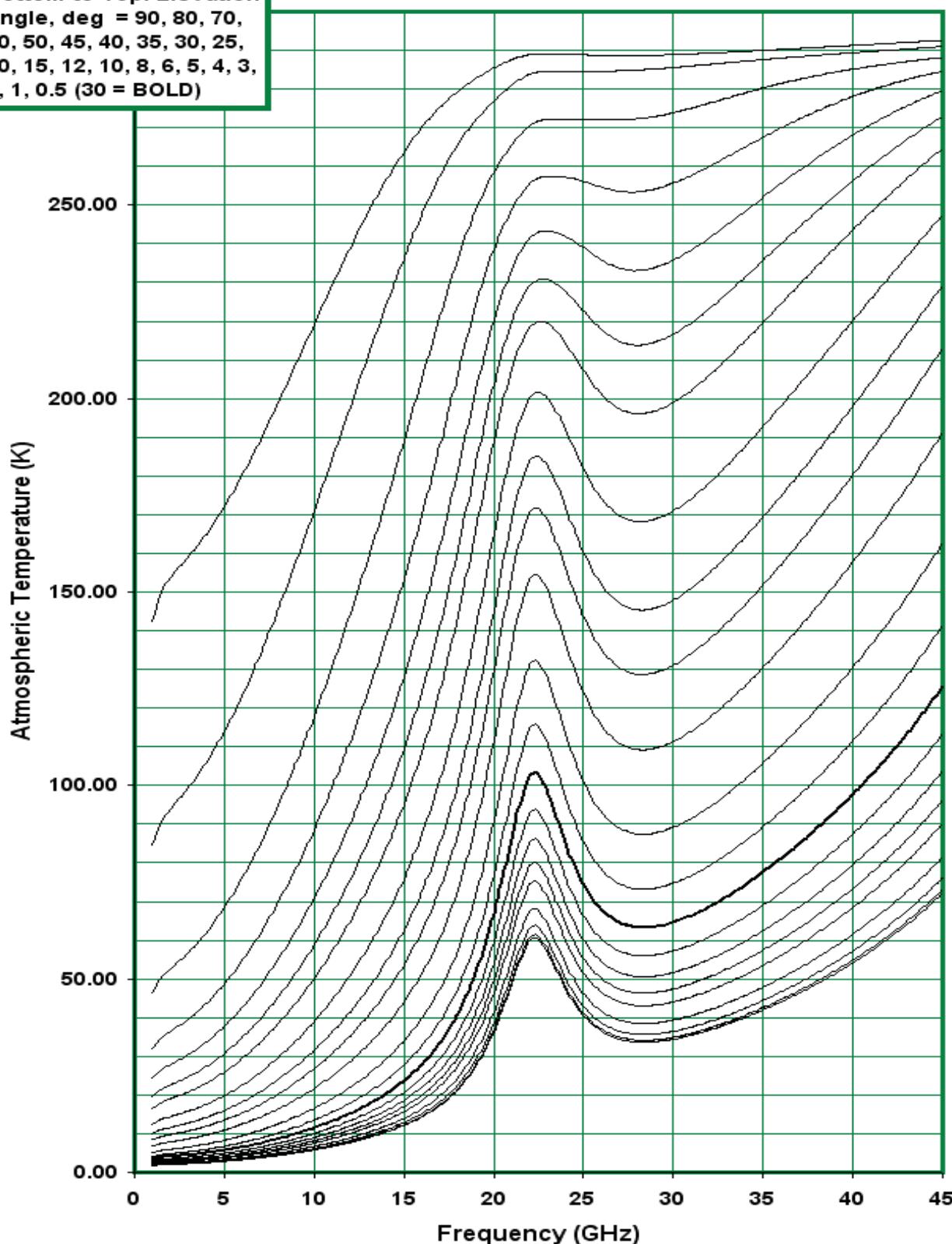
Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

Station = Goldstone

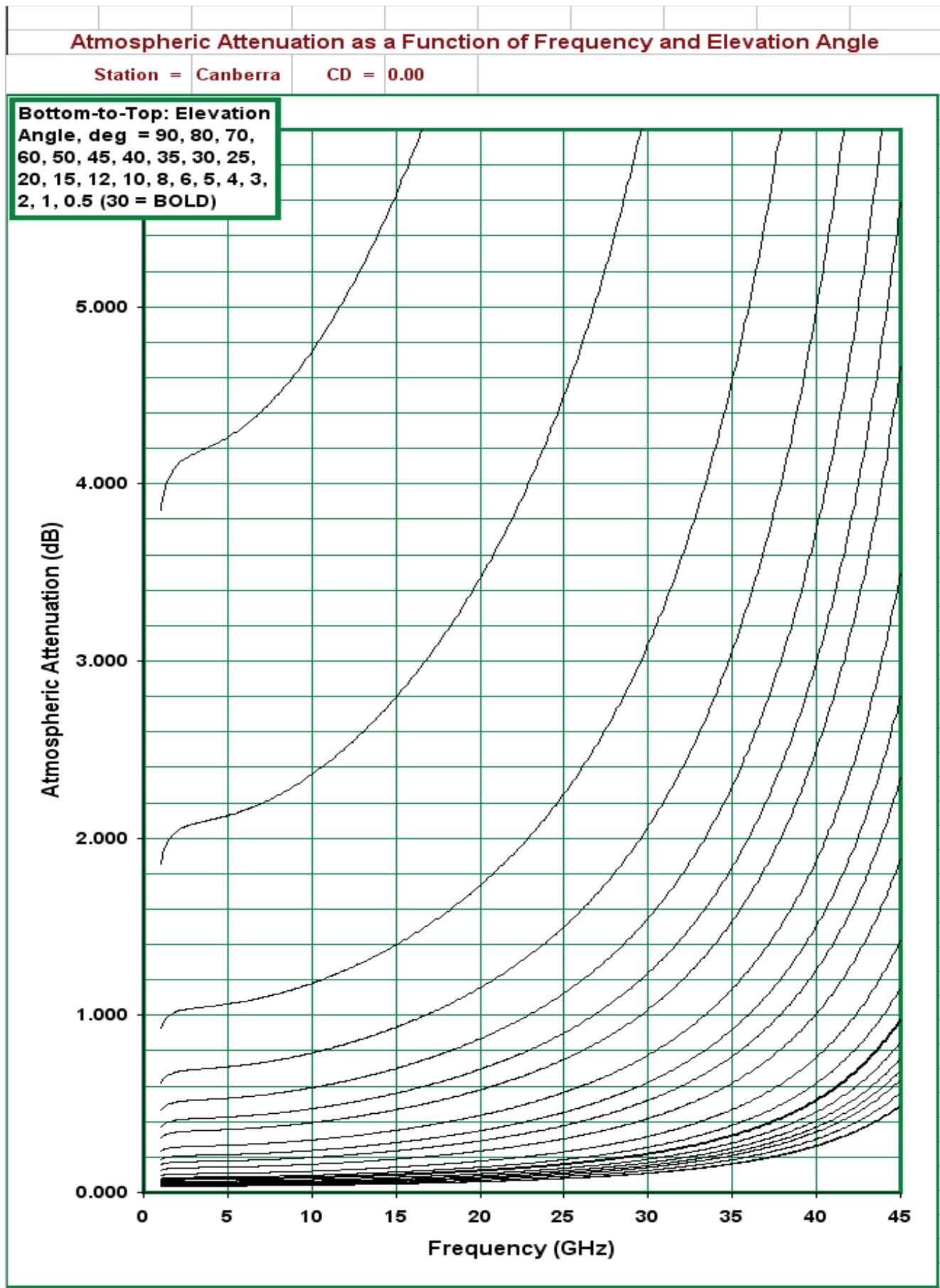
CD = 0.99

as a Function of Frequency and Elevation Angle

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)



Canberra Stations



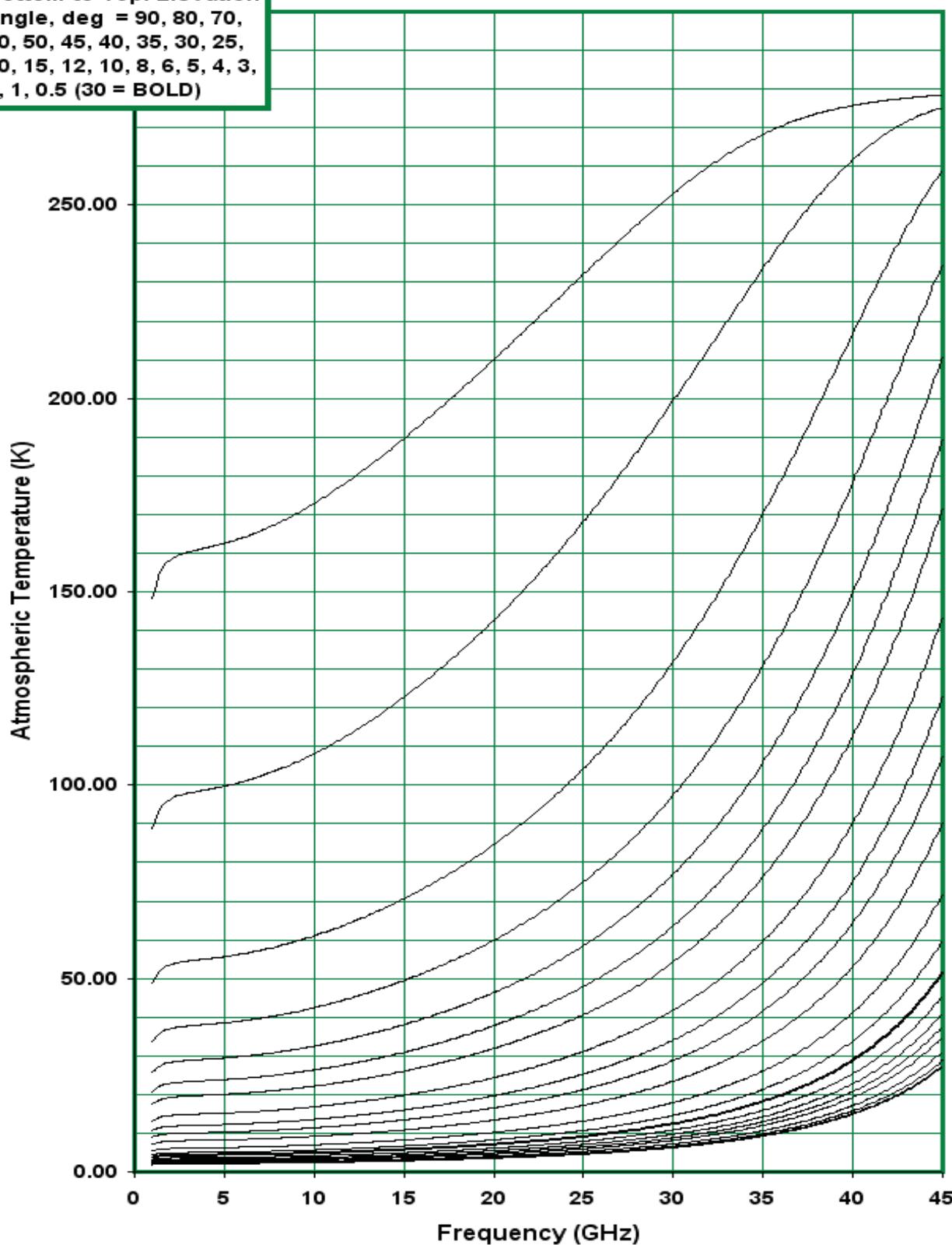
Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

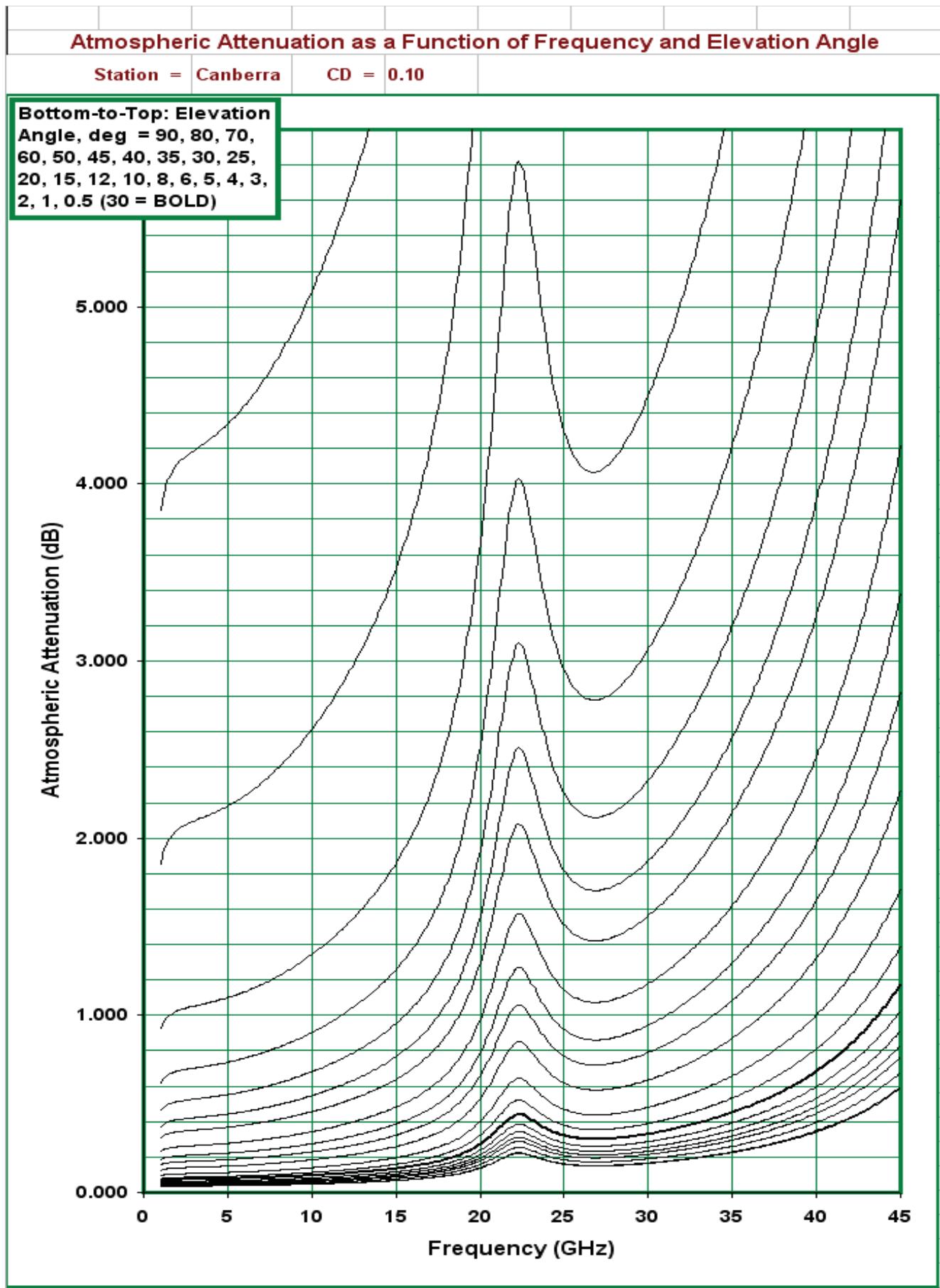
Station = Canberra

CD = 0.00

as a Function of Frequency and Elevation Angle

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)





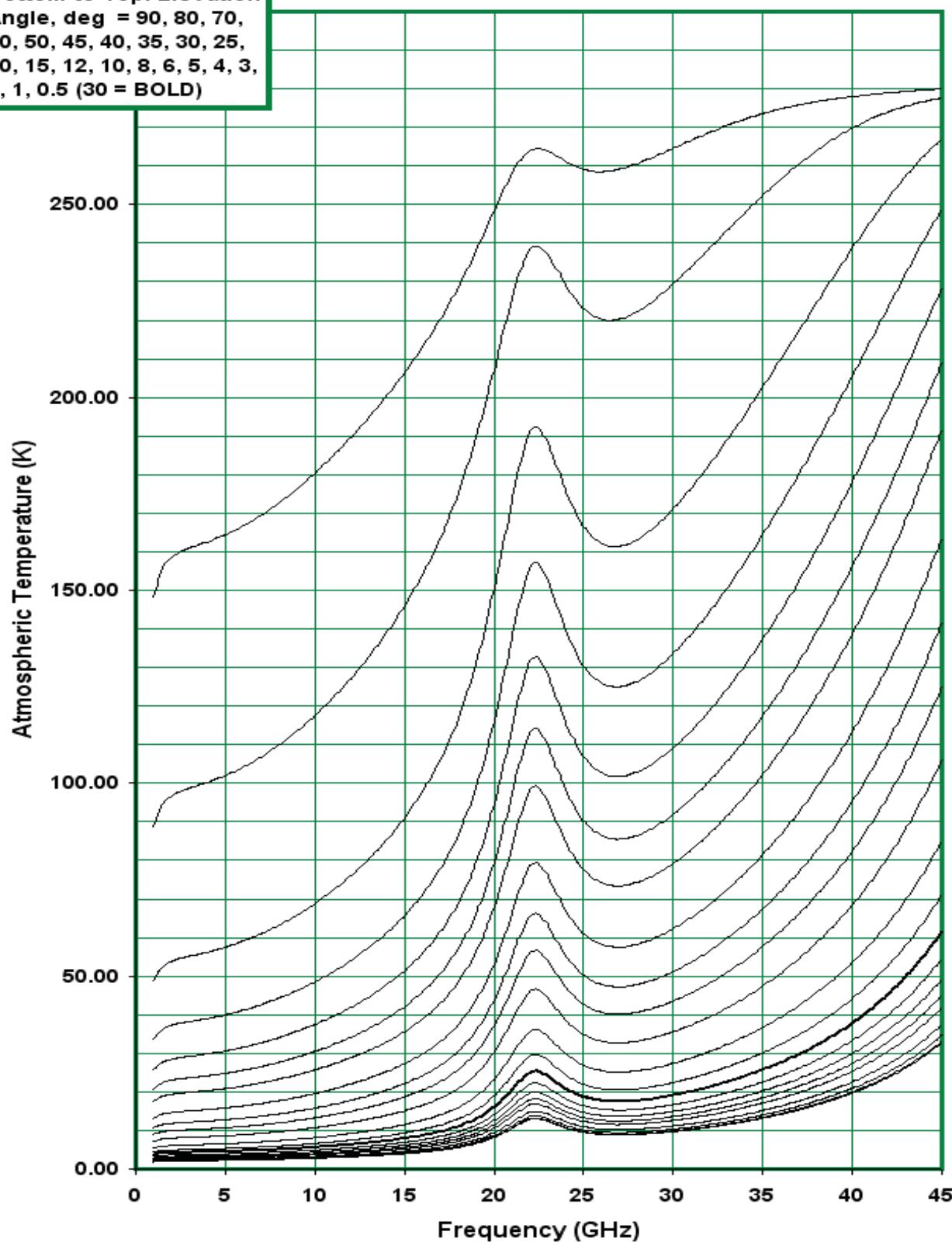
Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

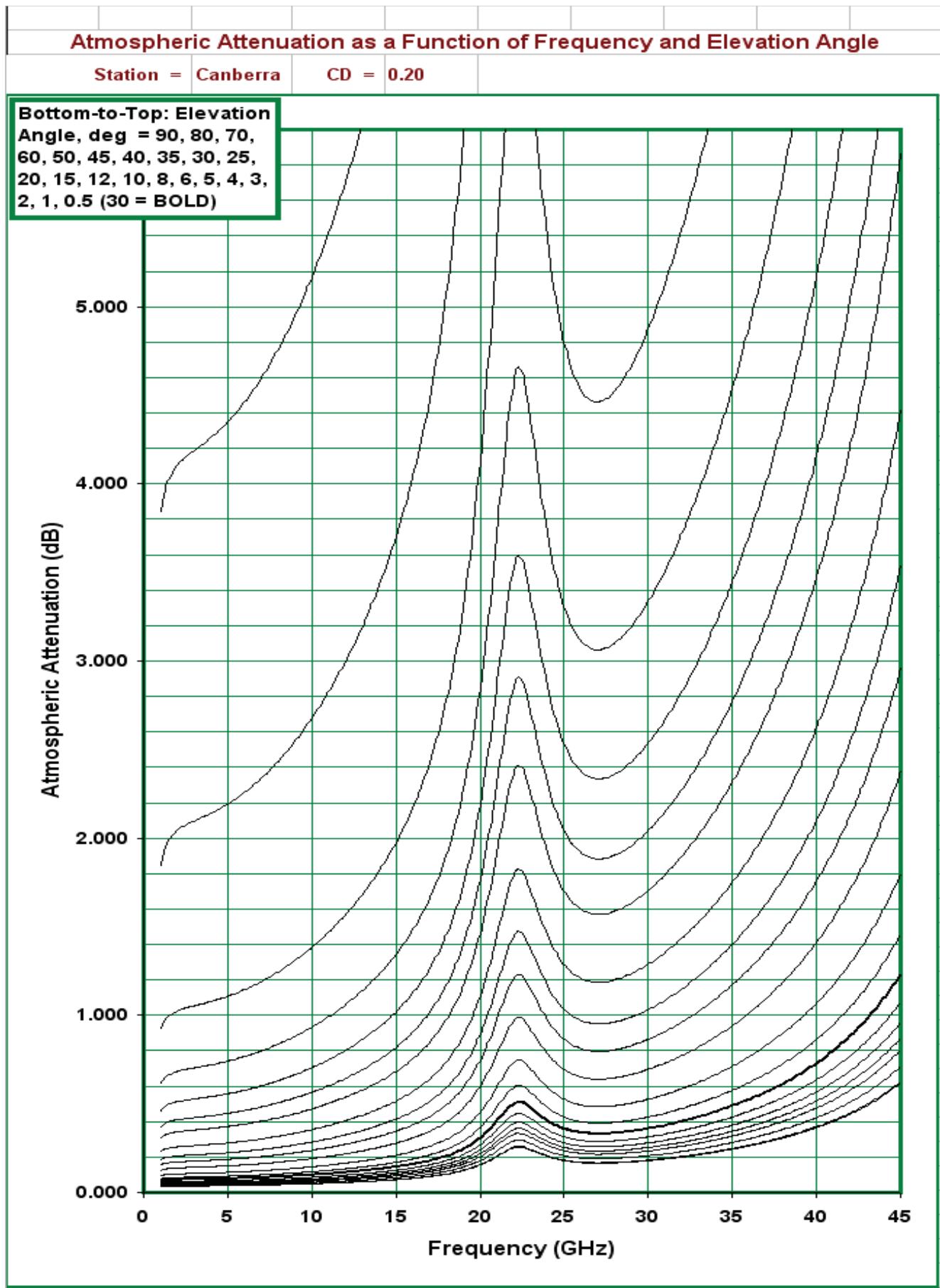
Station = Canberra

CD = 0.10

as a Function of Frequency and Elevation Angle

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)





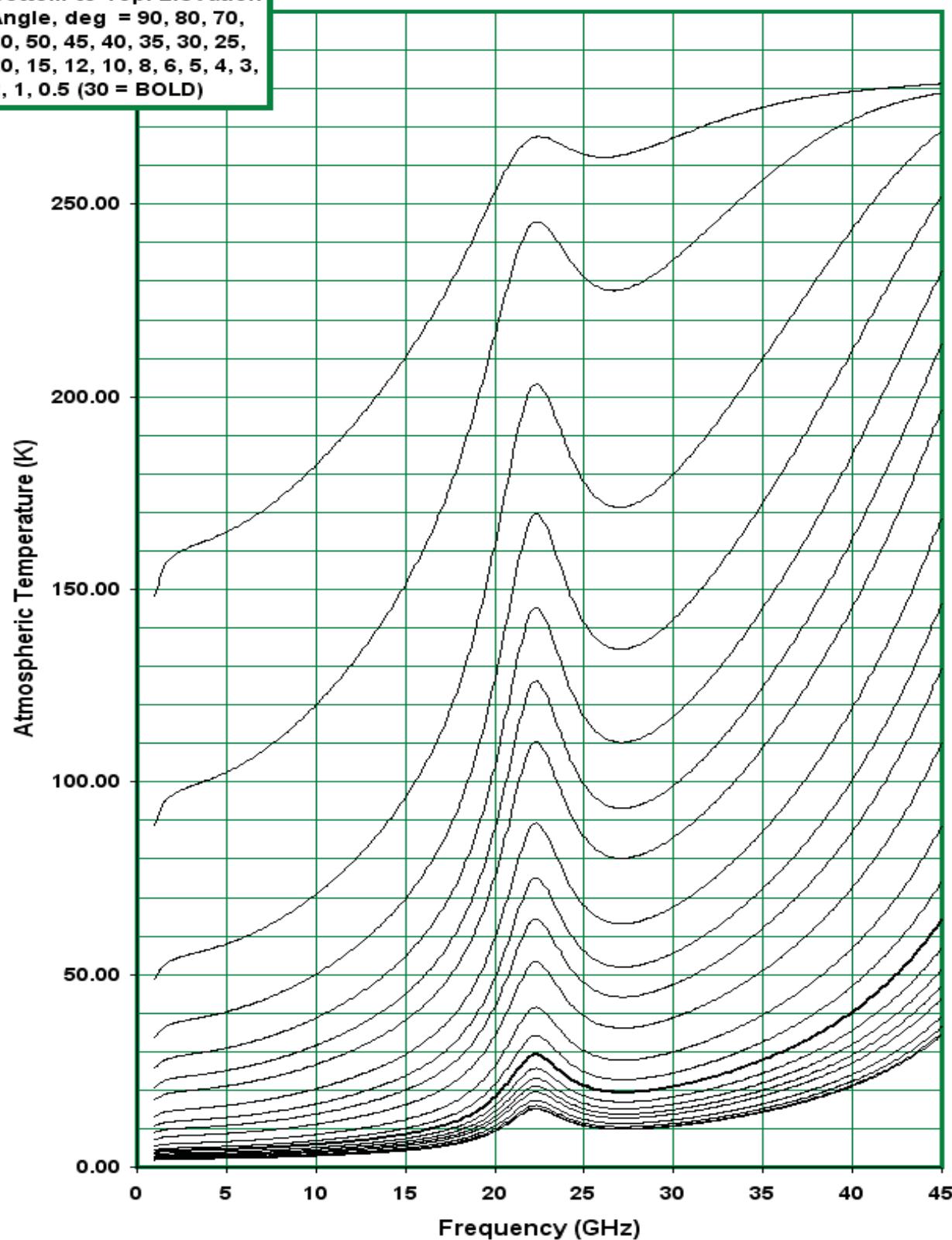
Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

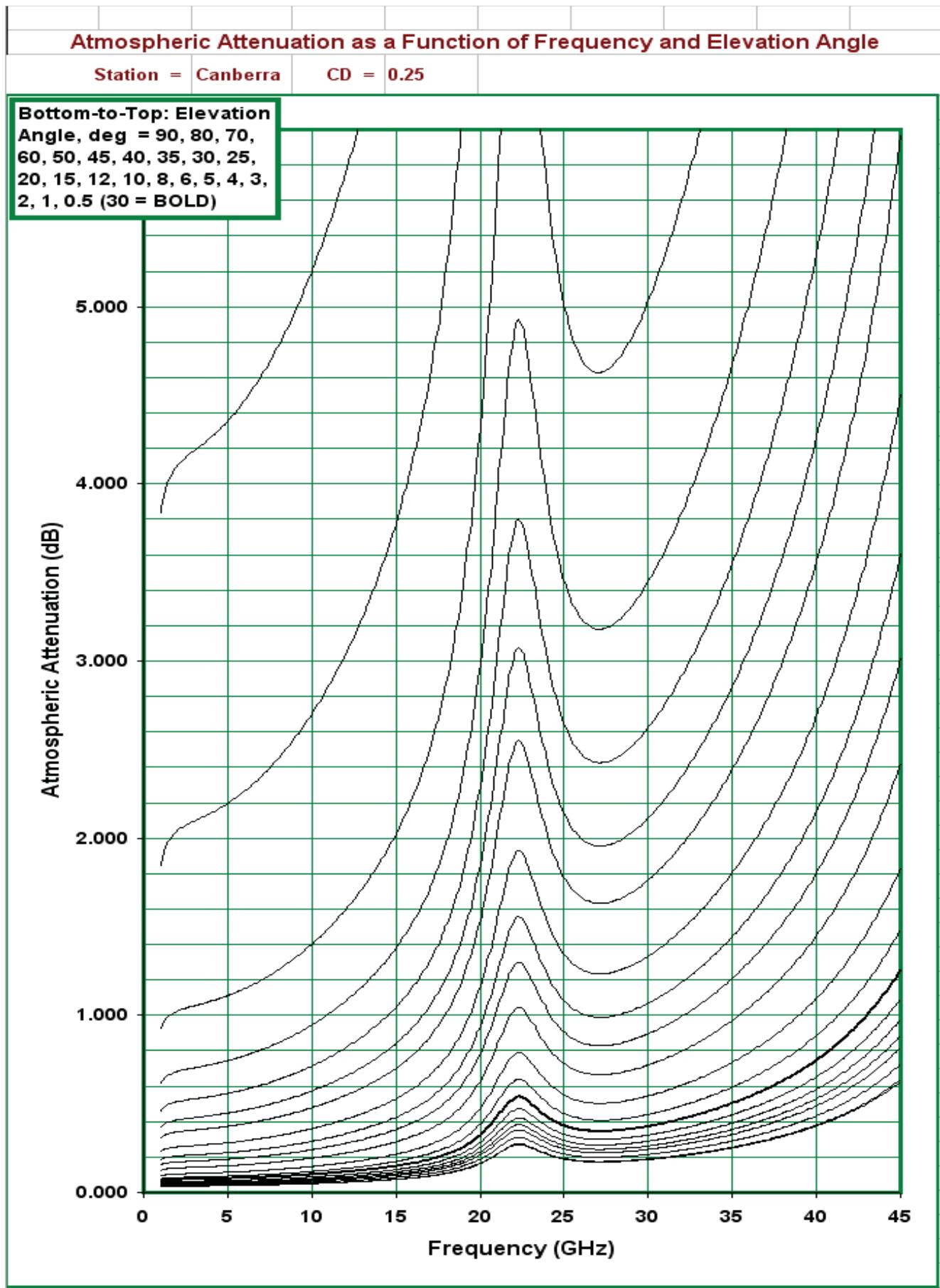
Station = Canberra

CD = 0.20

as a Function of Frequency and Elevation Angle

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)





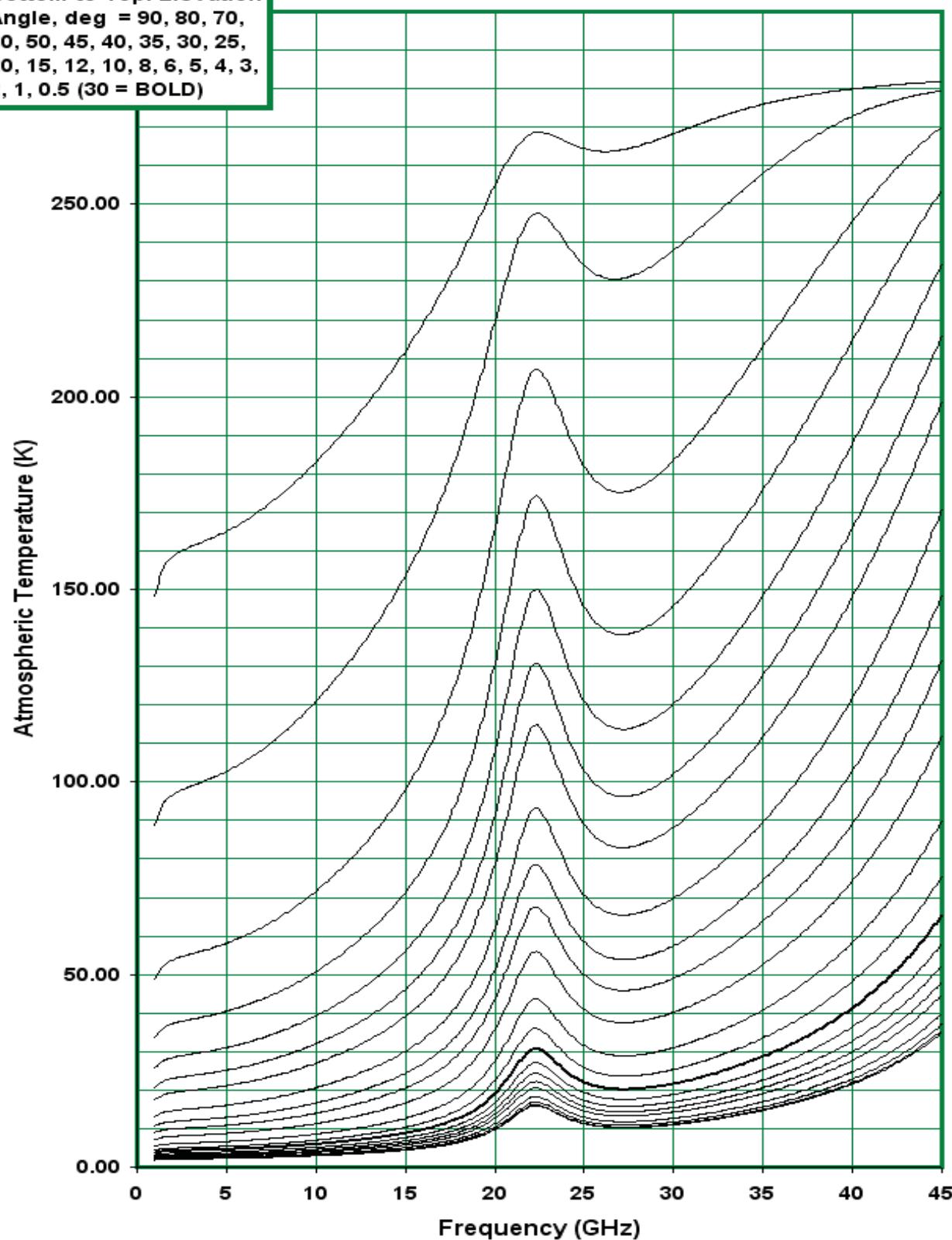
Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

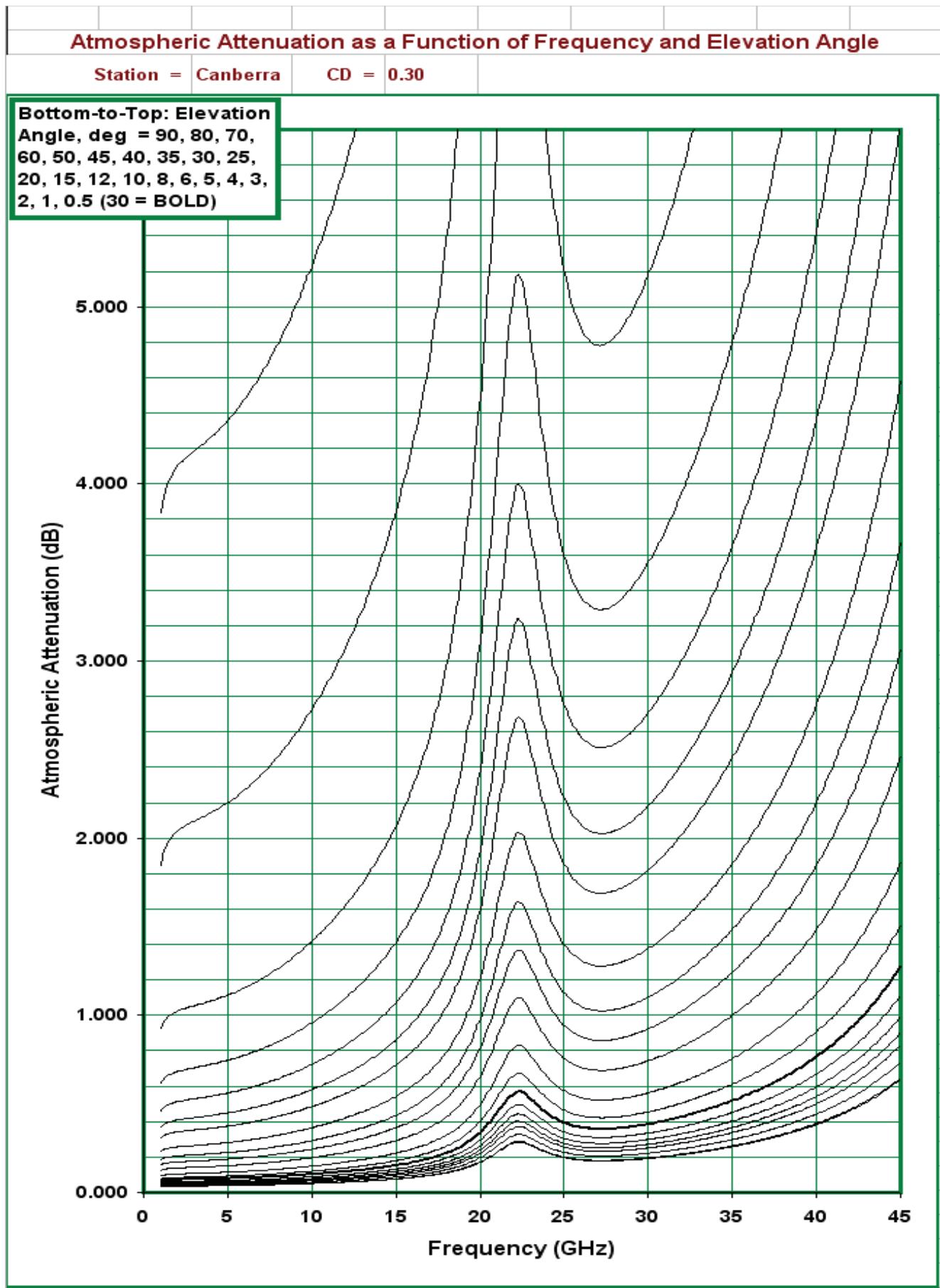
Station = Canberra

CD = 0.25

as a Function of Frequency and Elevation Angle

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)





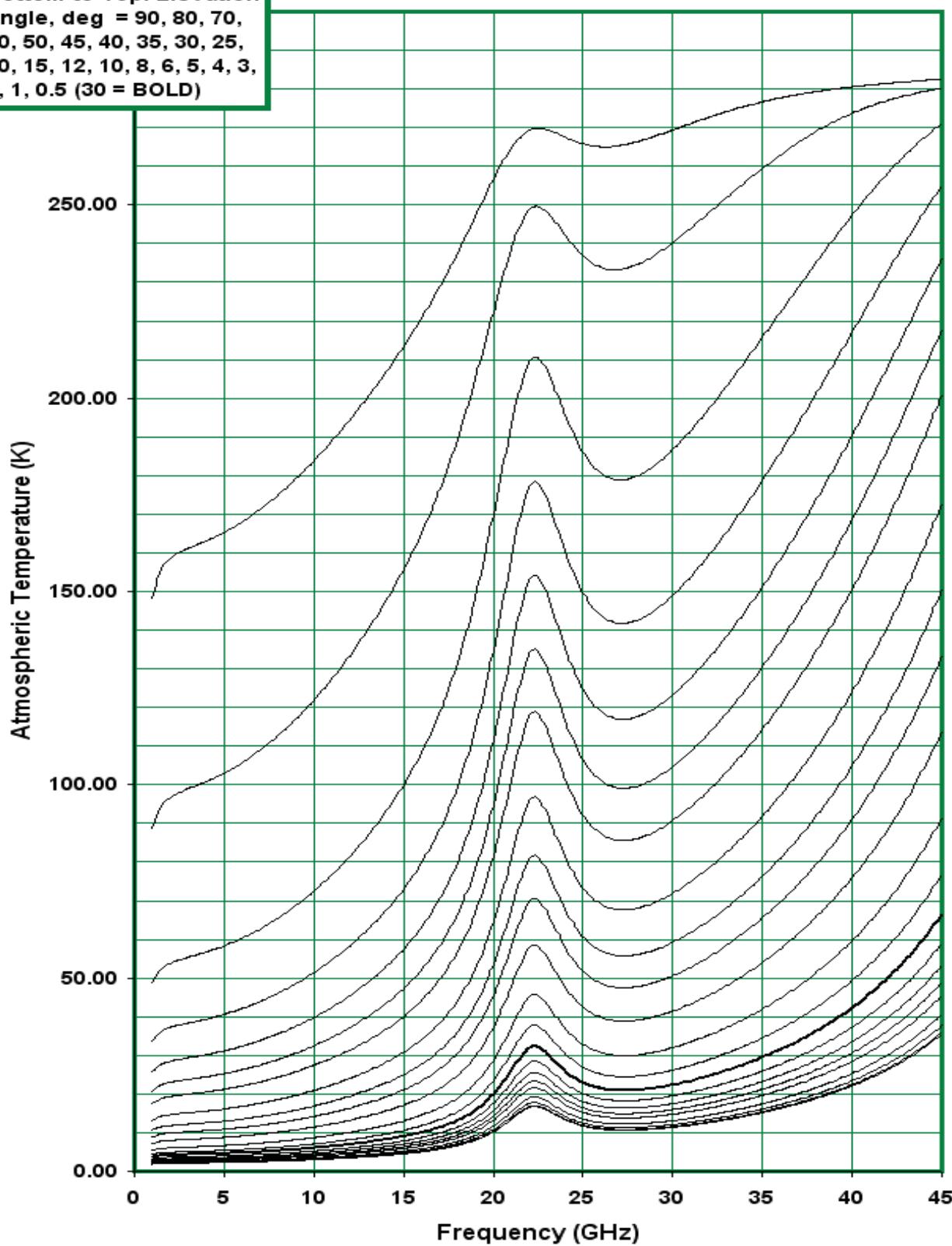
Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

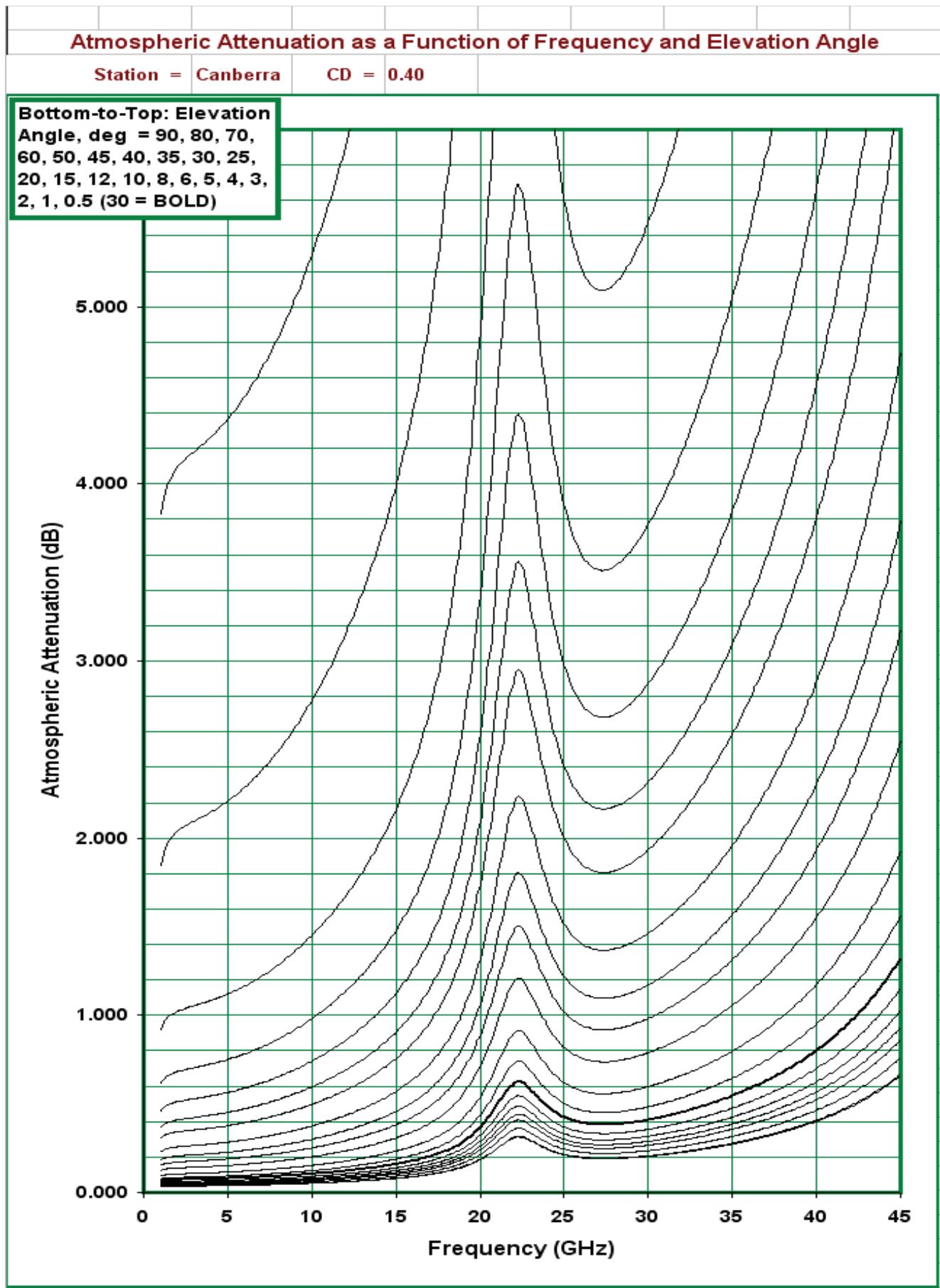
Station = Canberra

CD = 0.30

as a Function of Frequency and Elevation Angle

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)





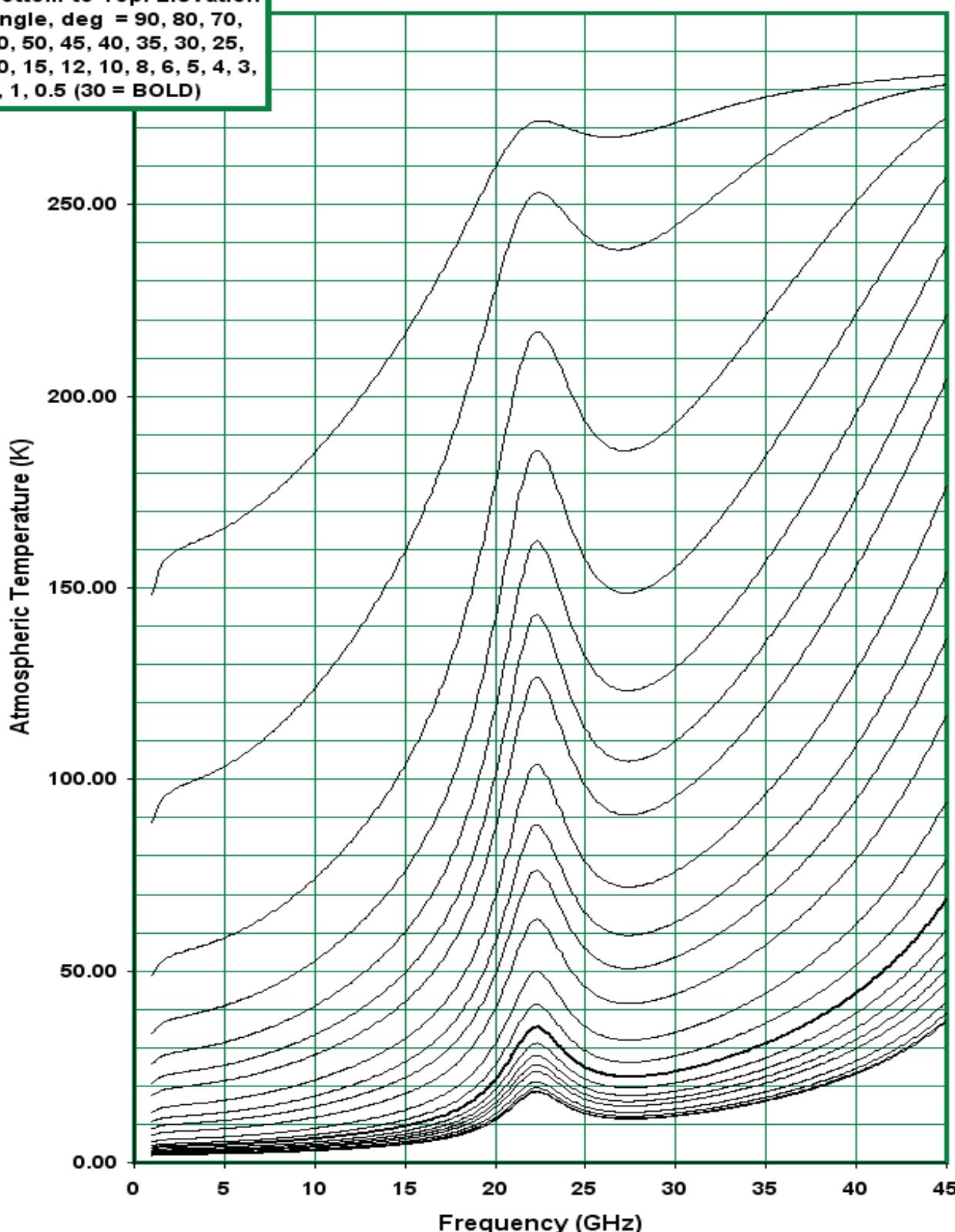
Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

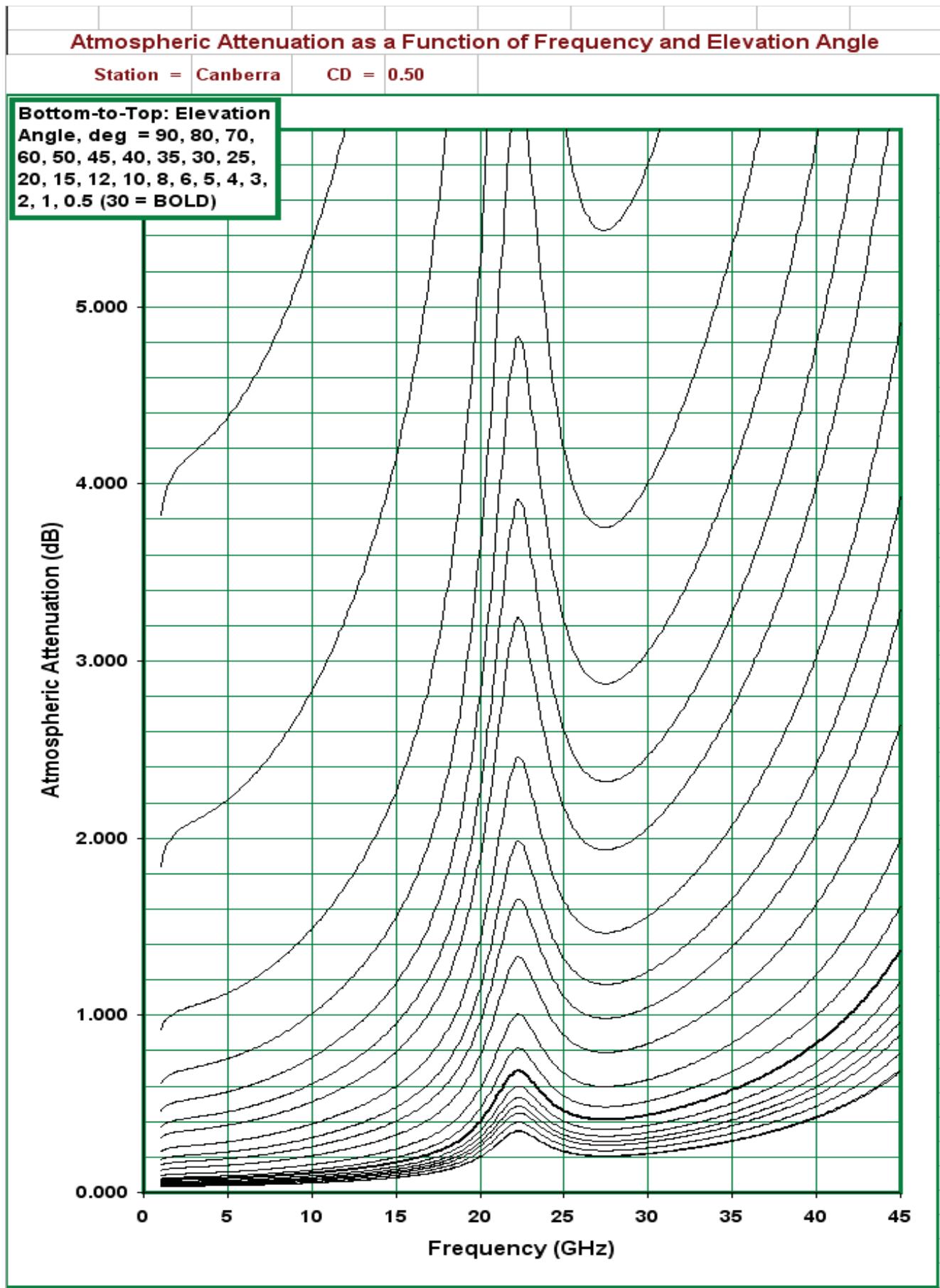
Station = Canberra

CD = 0.40

as a Function of Frequency and Elevation Angle

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)





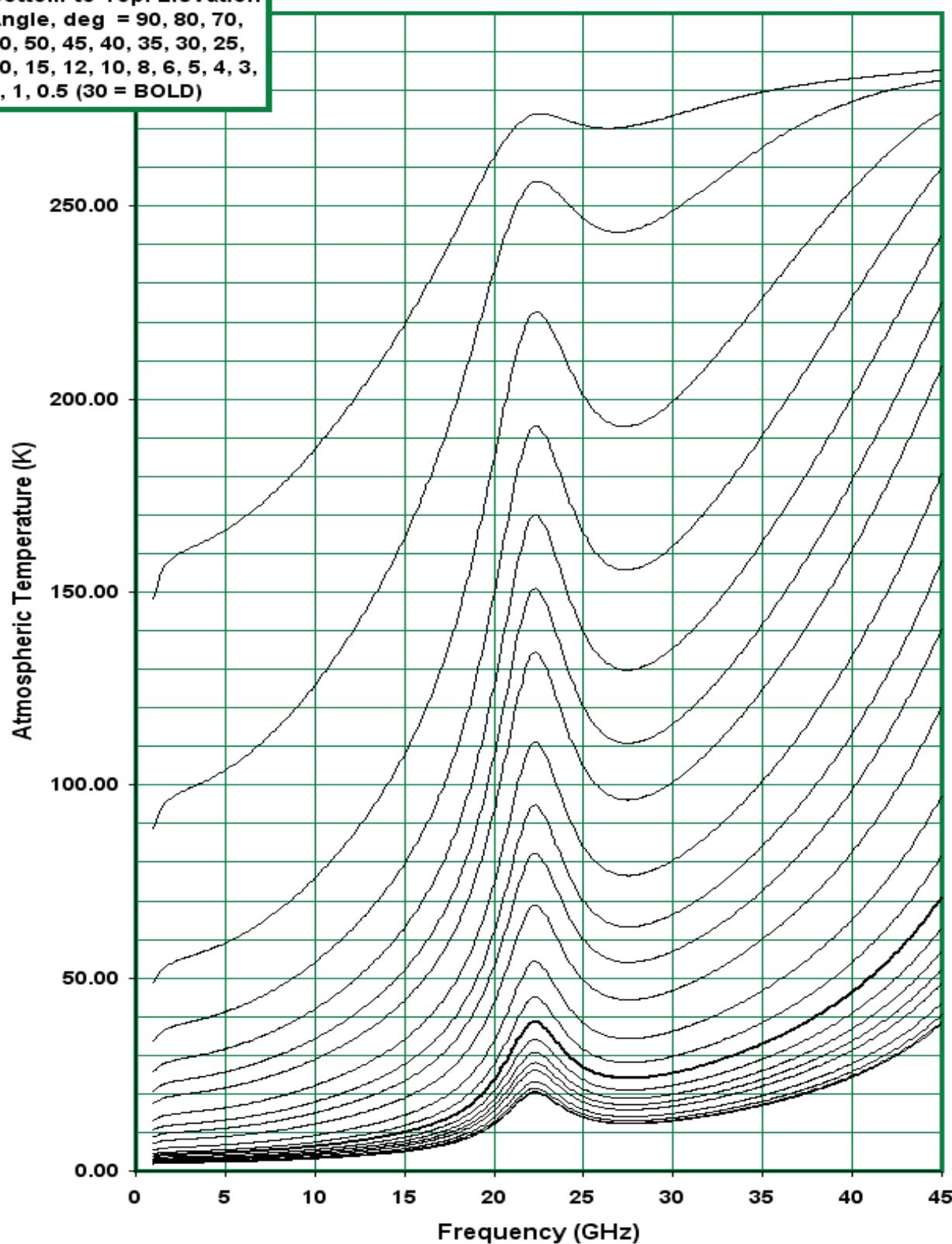
Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

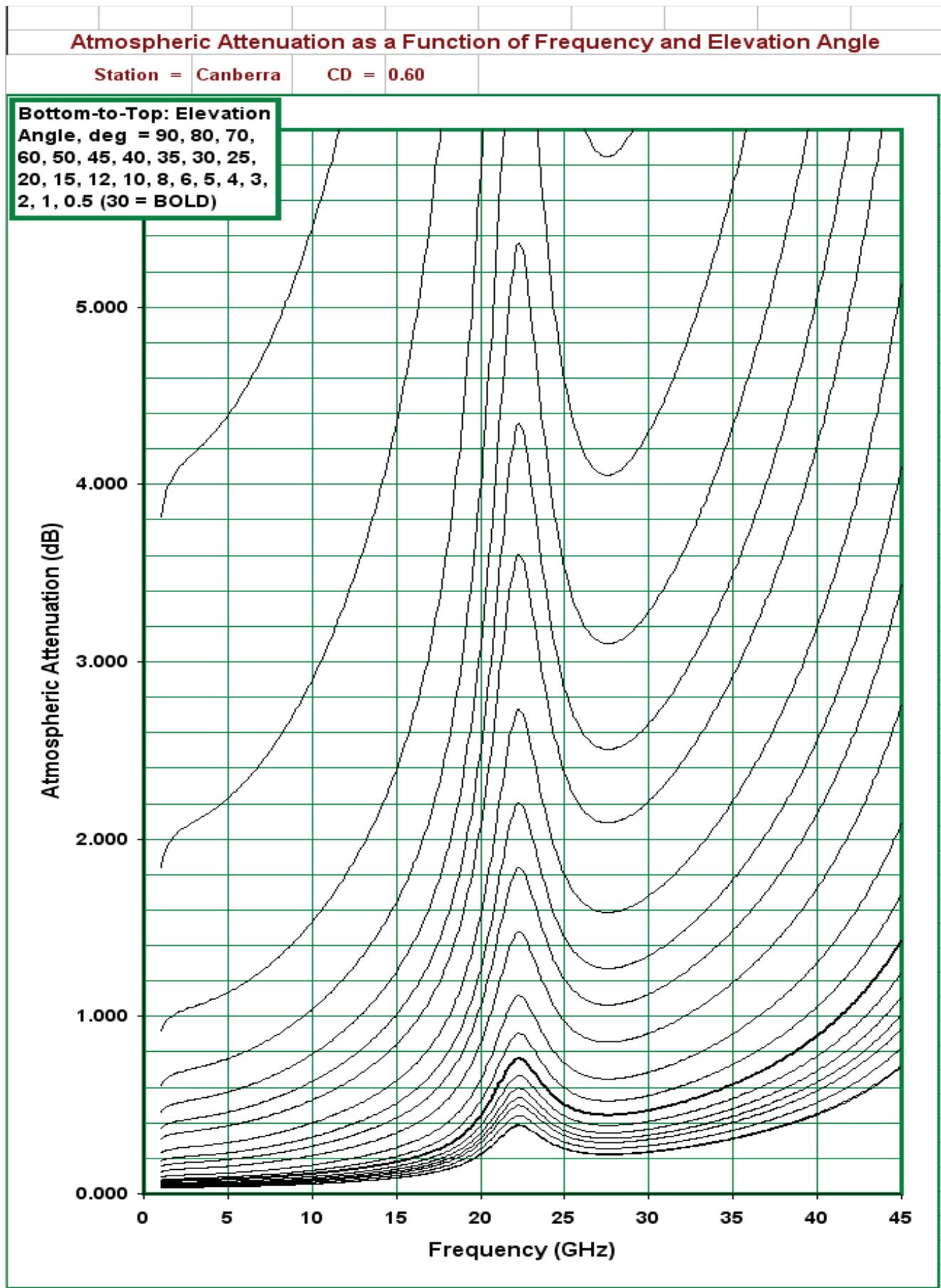
Station = Canberra

CD = 0.50

as a Function of Frequency and Elevation Angle

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)





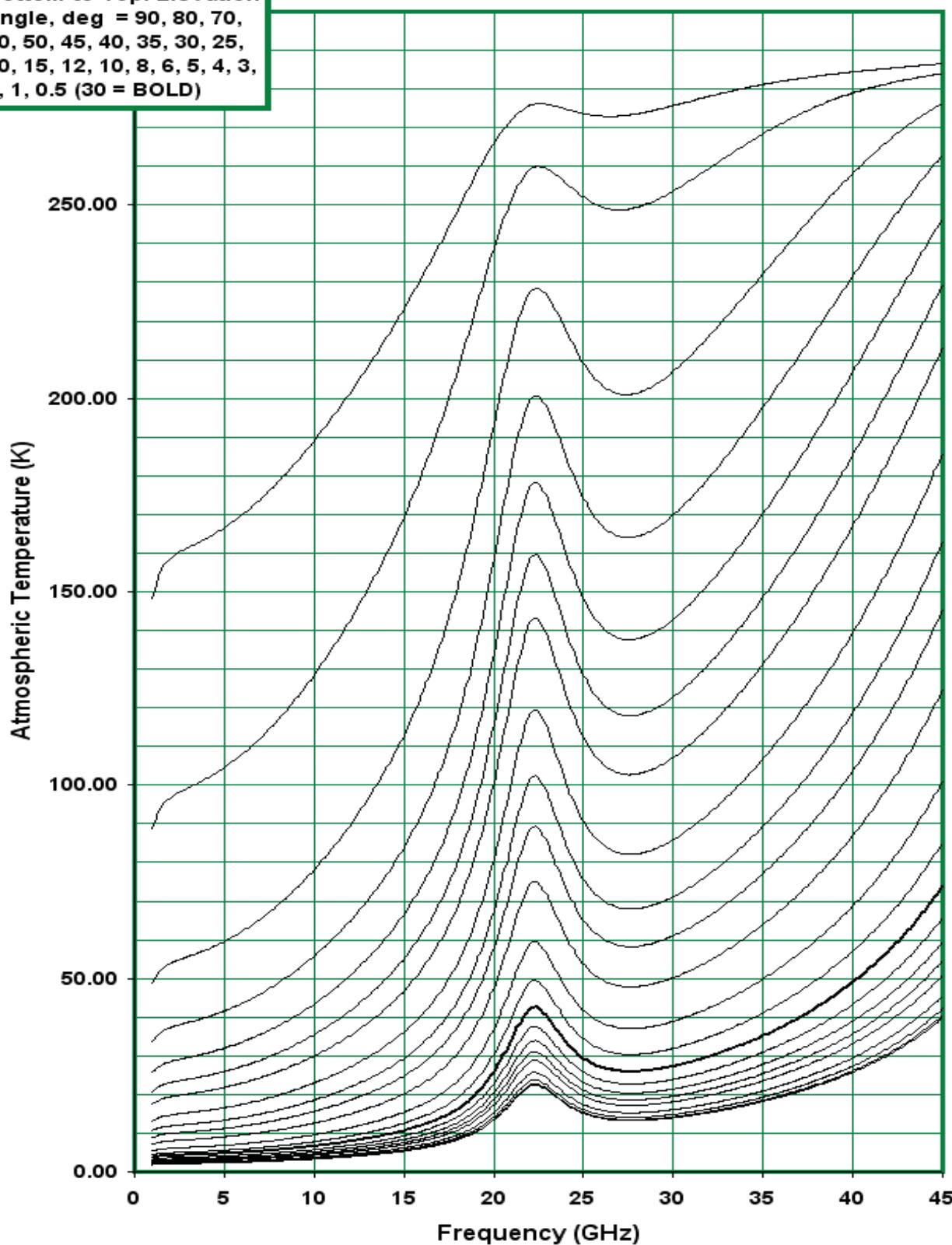
Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

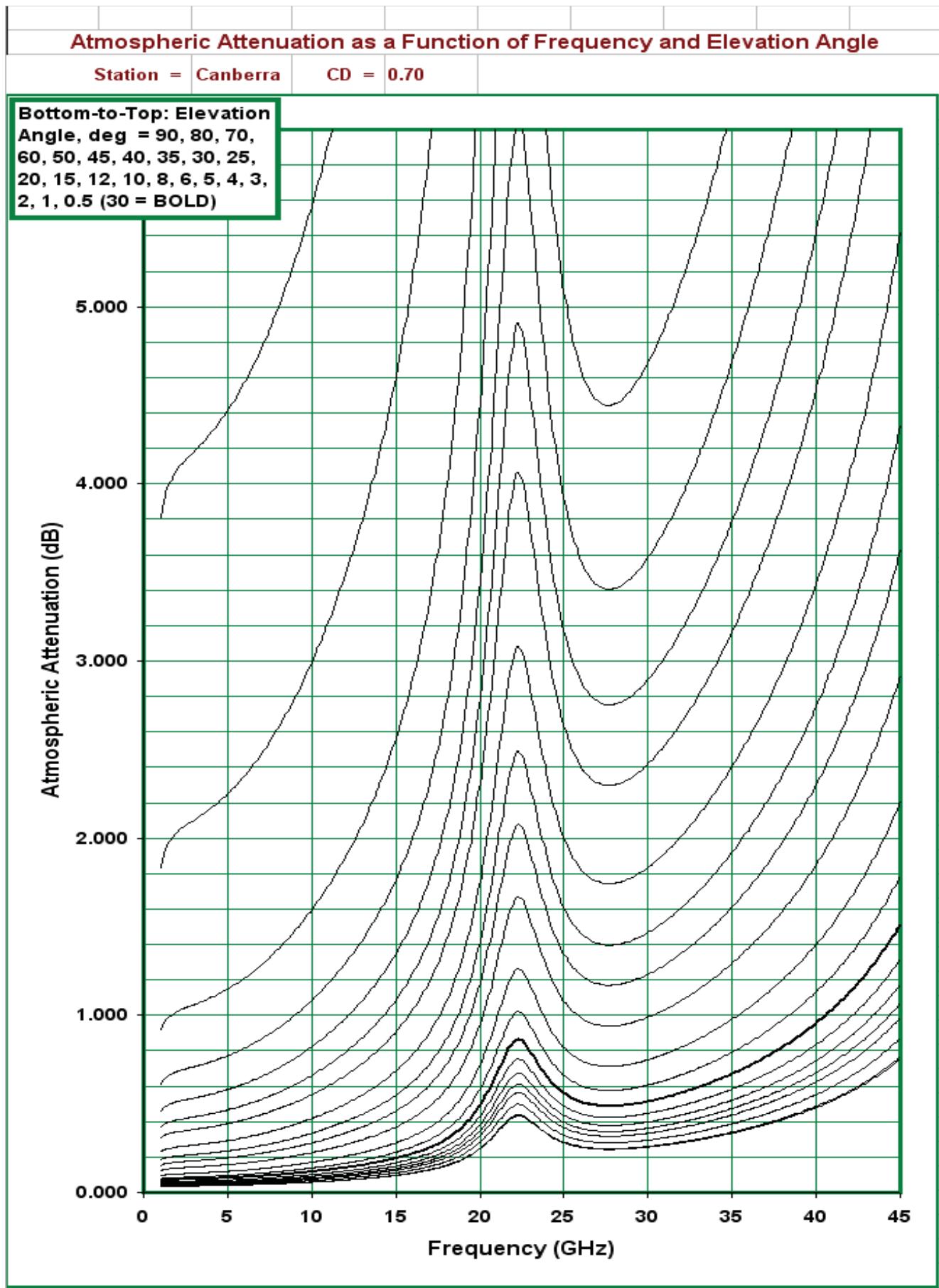
Station = Canberra

CD = 0.60

as a Function of Frequency and Elevation Angle

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)





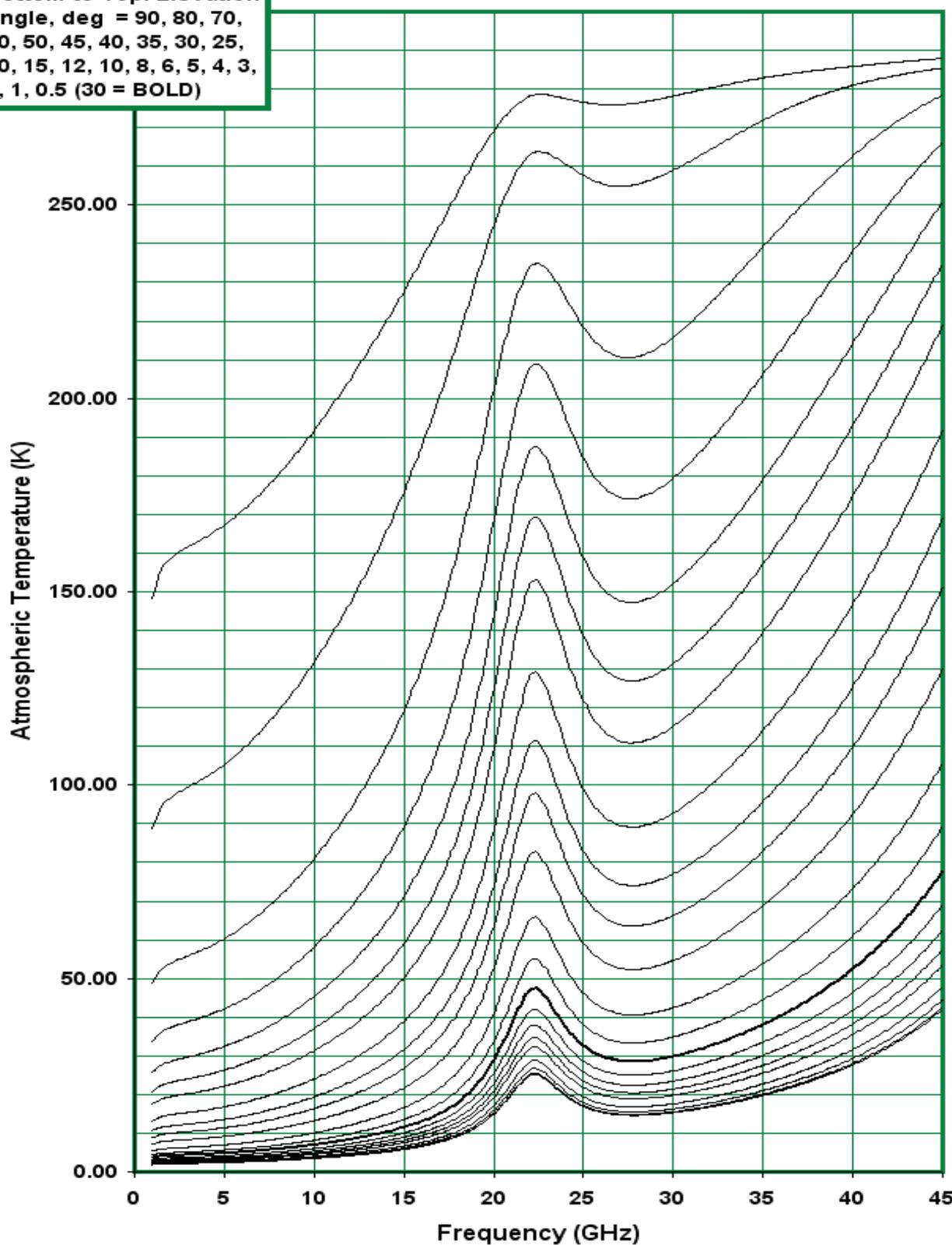
Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

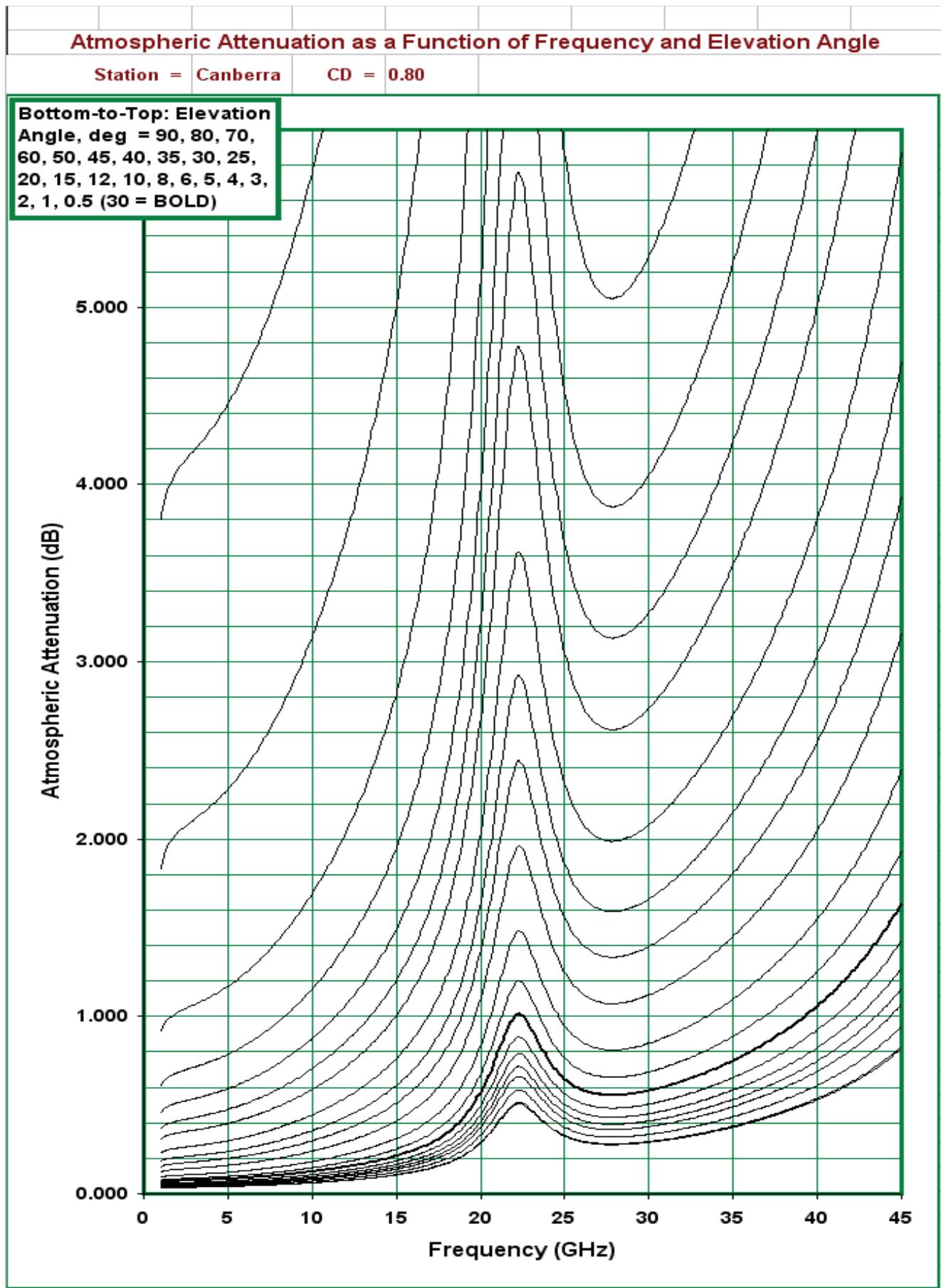
Station = Canberra

CD = 0.70

as a Function of Frequency and Elevation Angle

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)





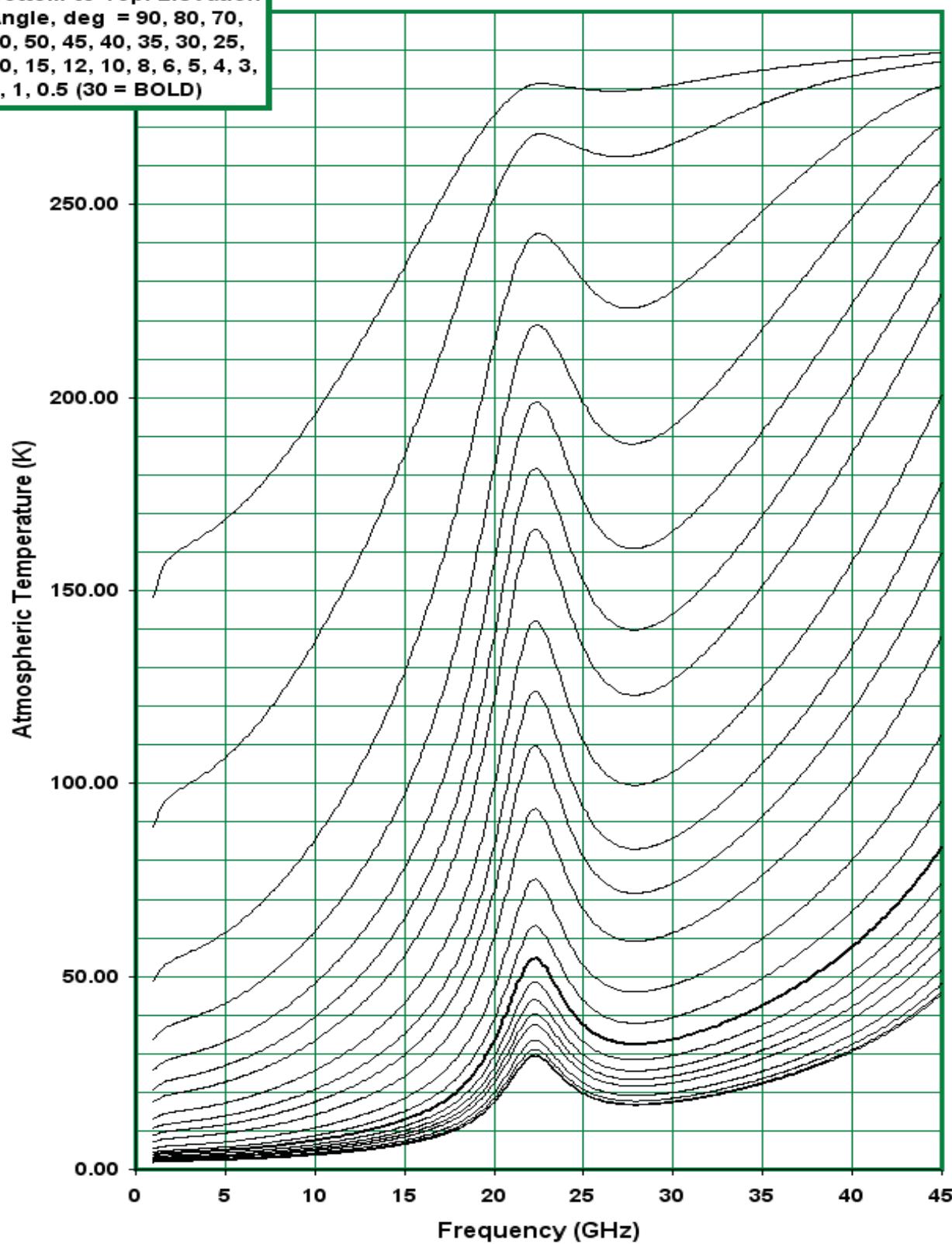
Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

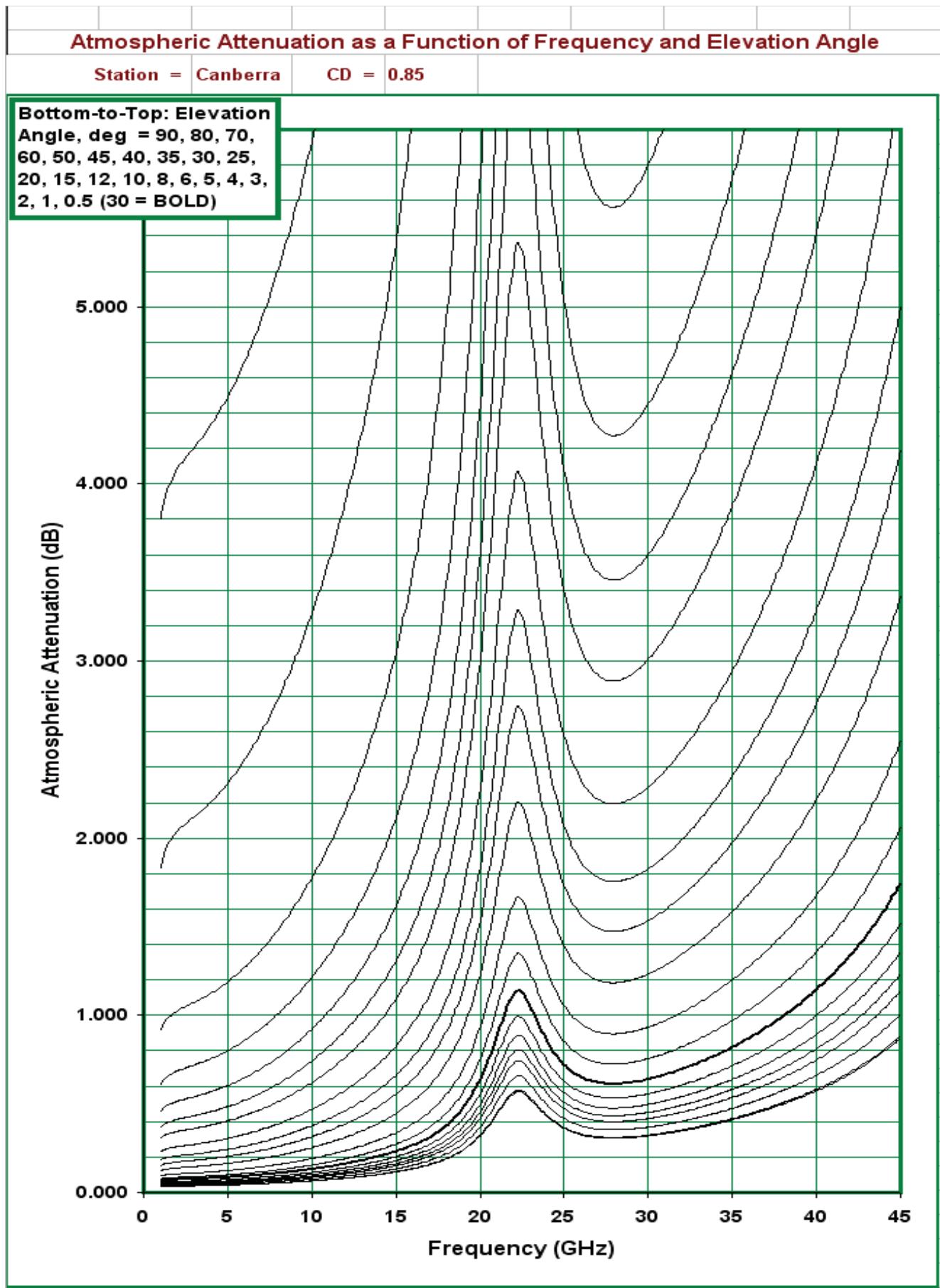
Station = Canberra

CD = 0.80

as a Function of Frequency and Elevation Angle

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)





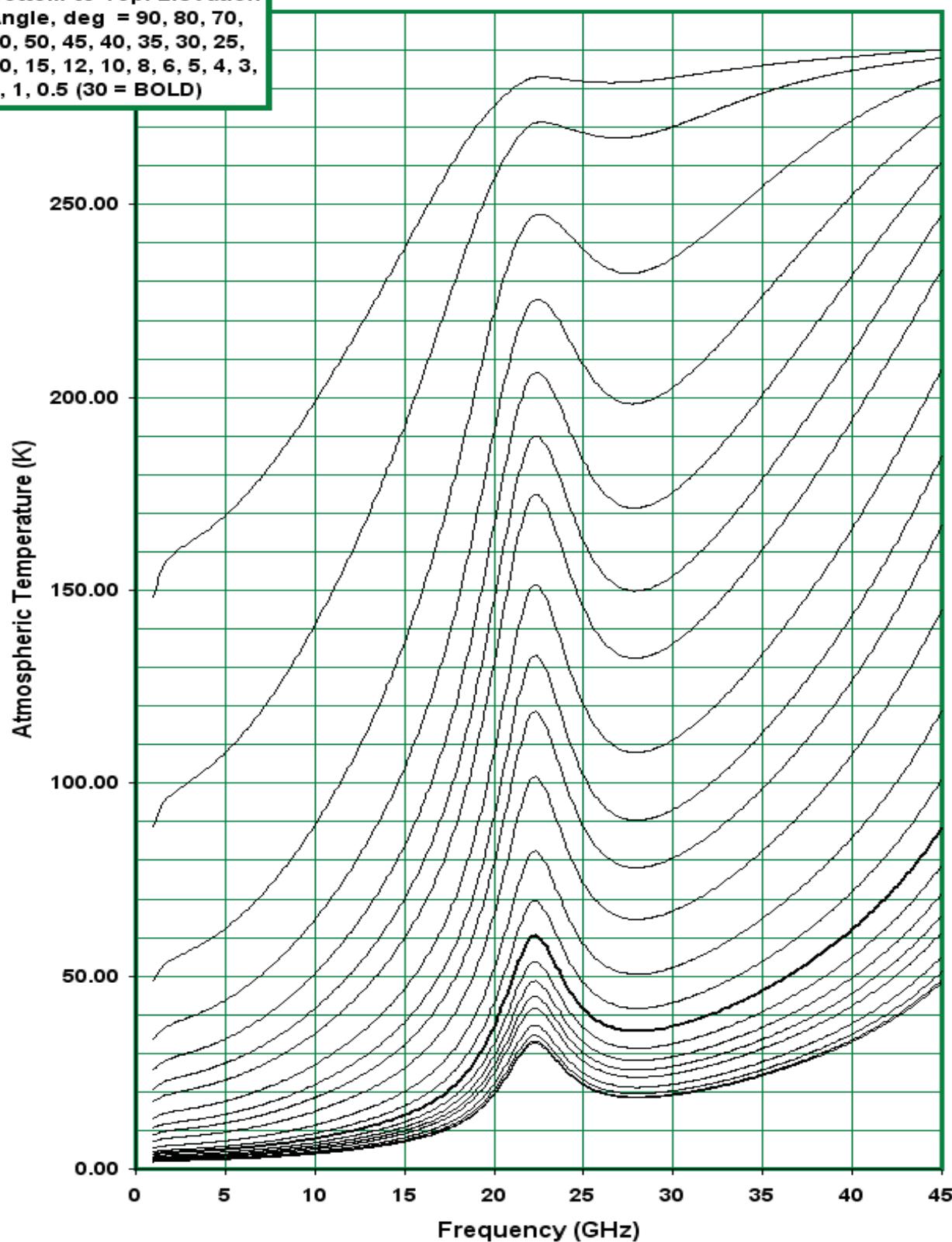
Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

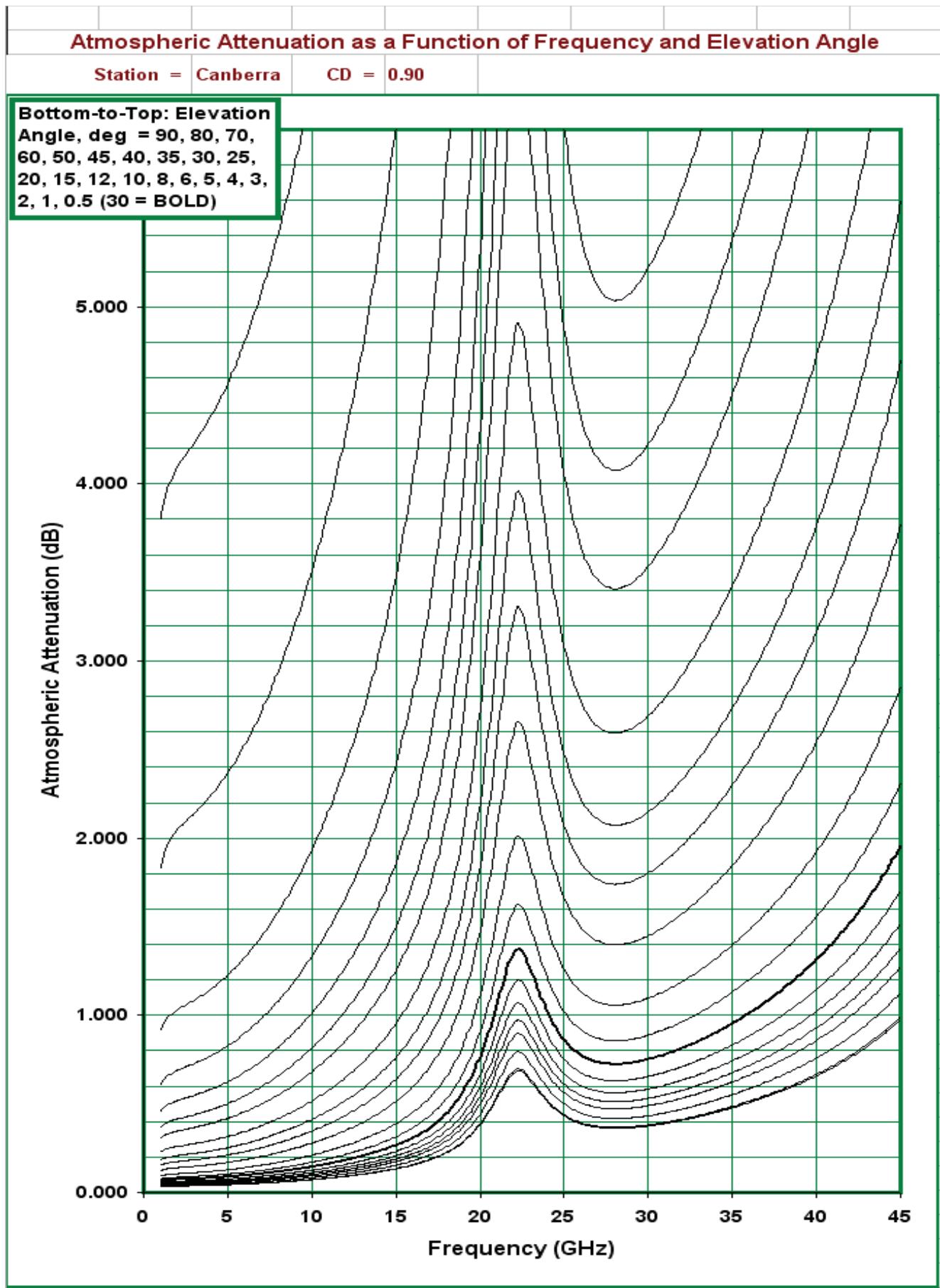
Station = Canberra

CD = 0.85

as a Function of Frequency and Elevation Angle

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)





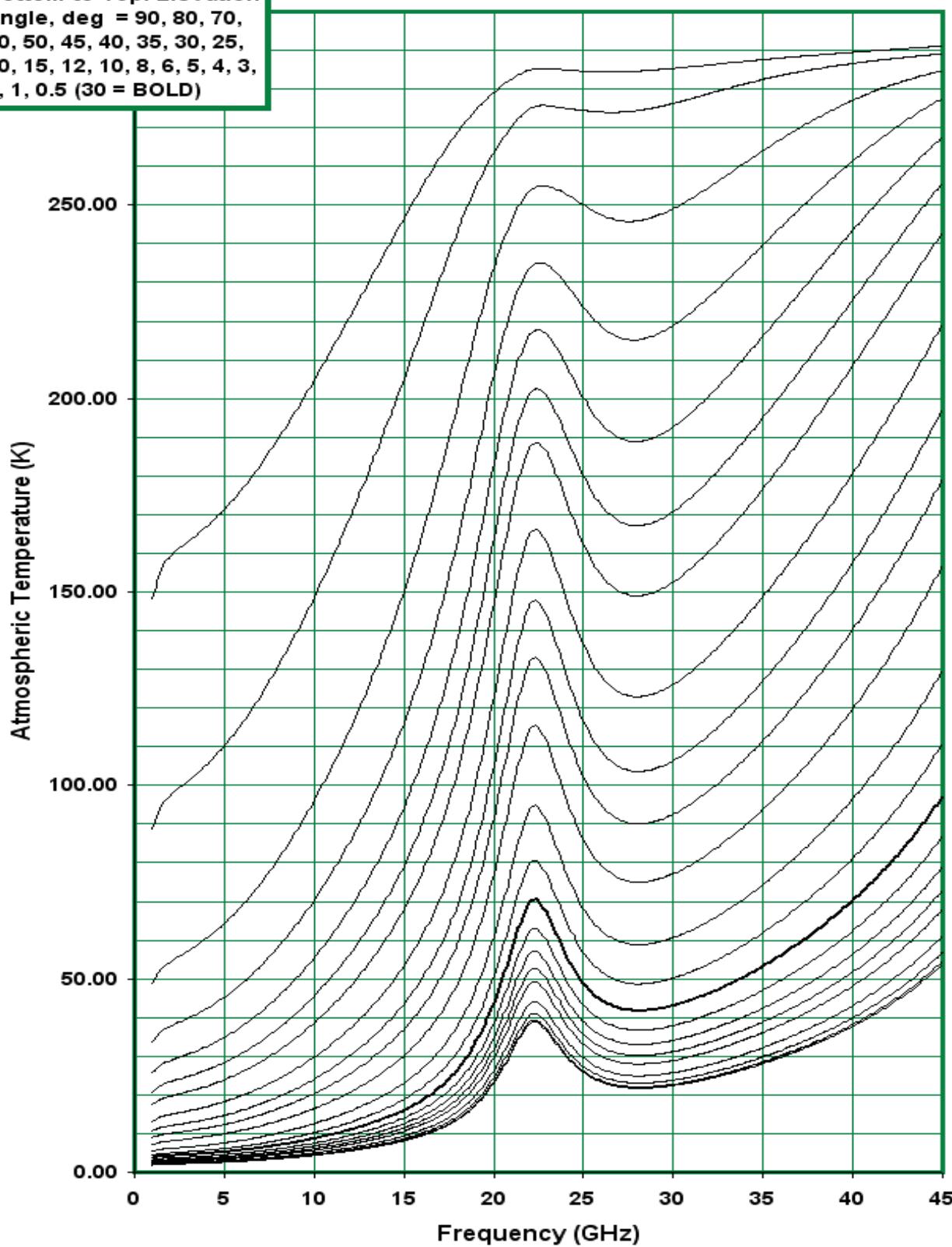
Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

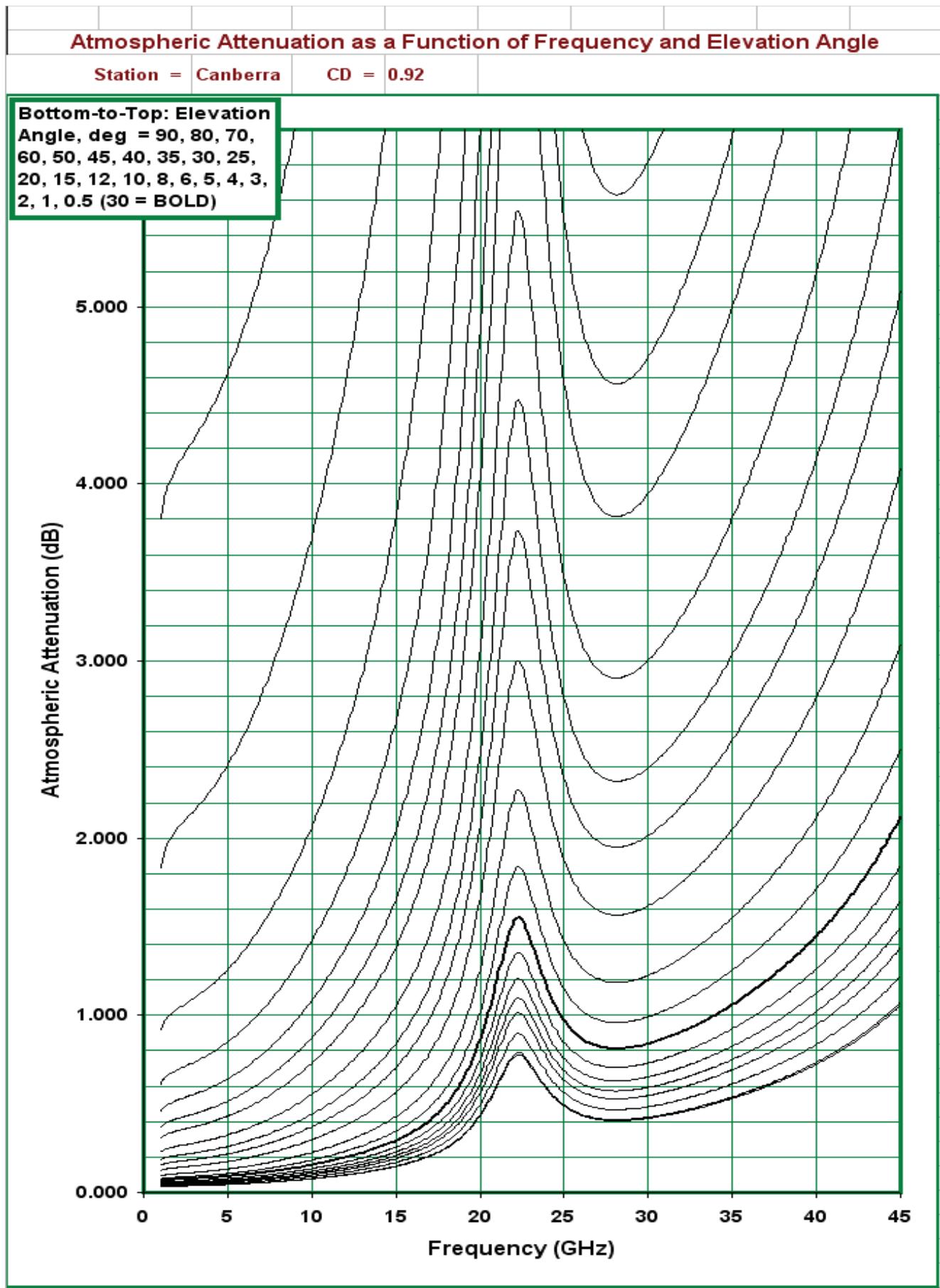
Station = Canberra

CD = 0.90

as a Function of Frequency and Elevation Angle

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)





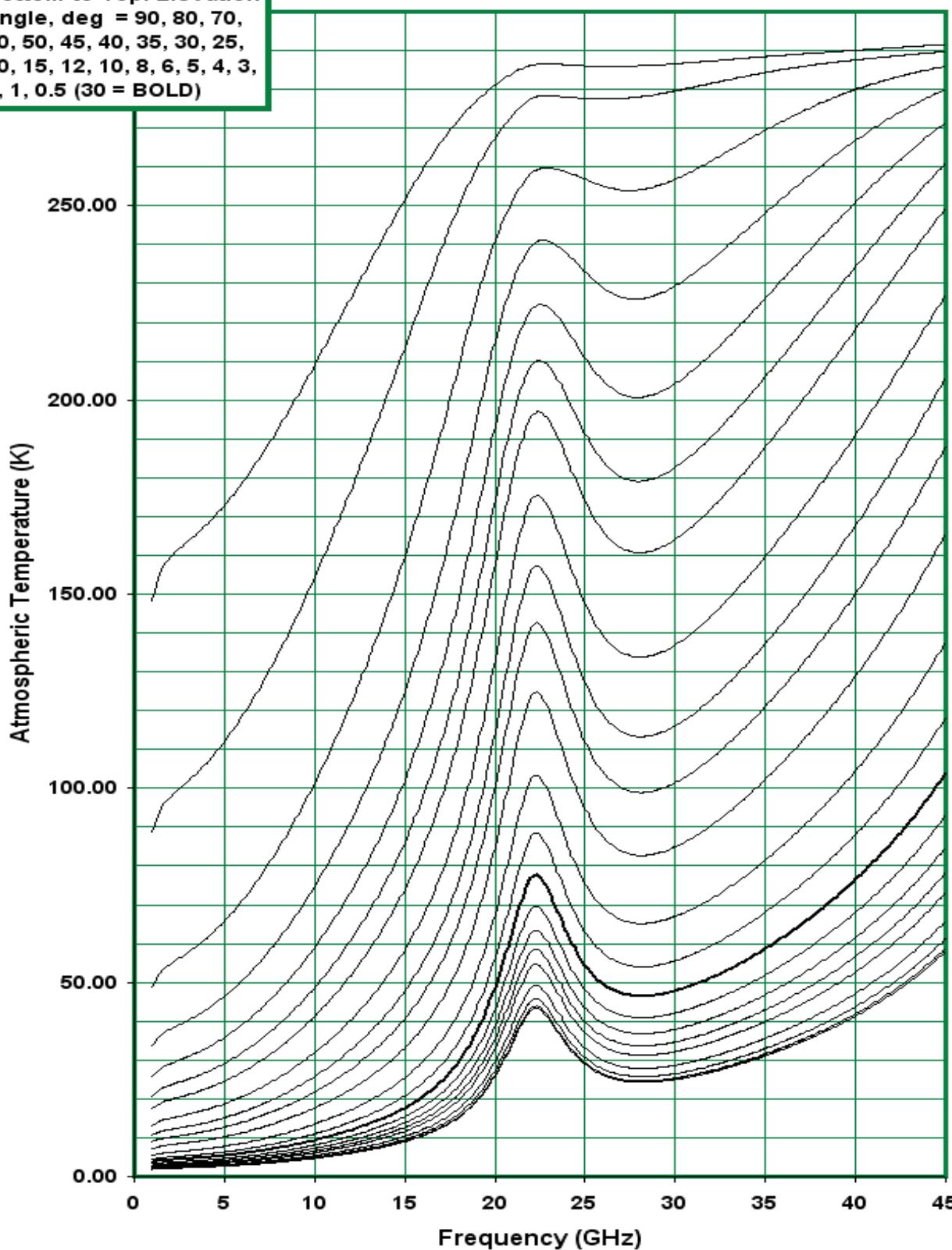
Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

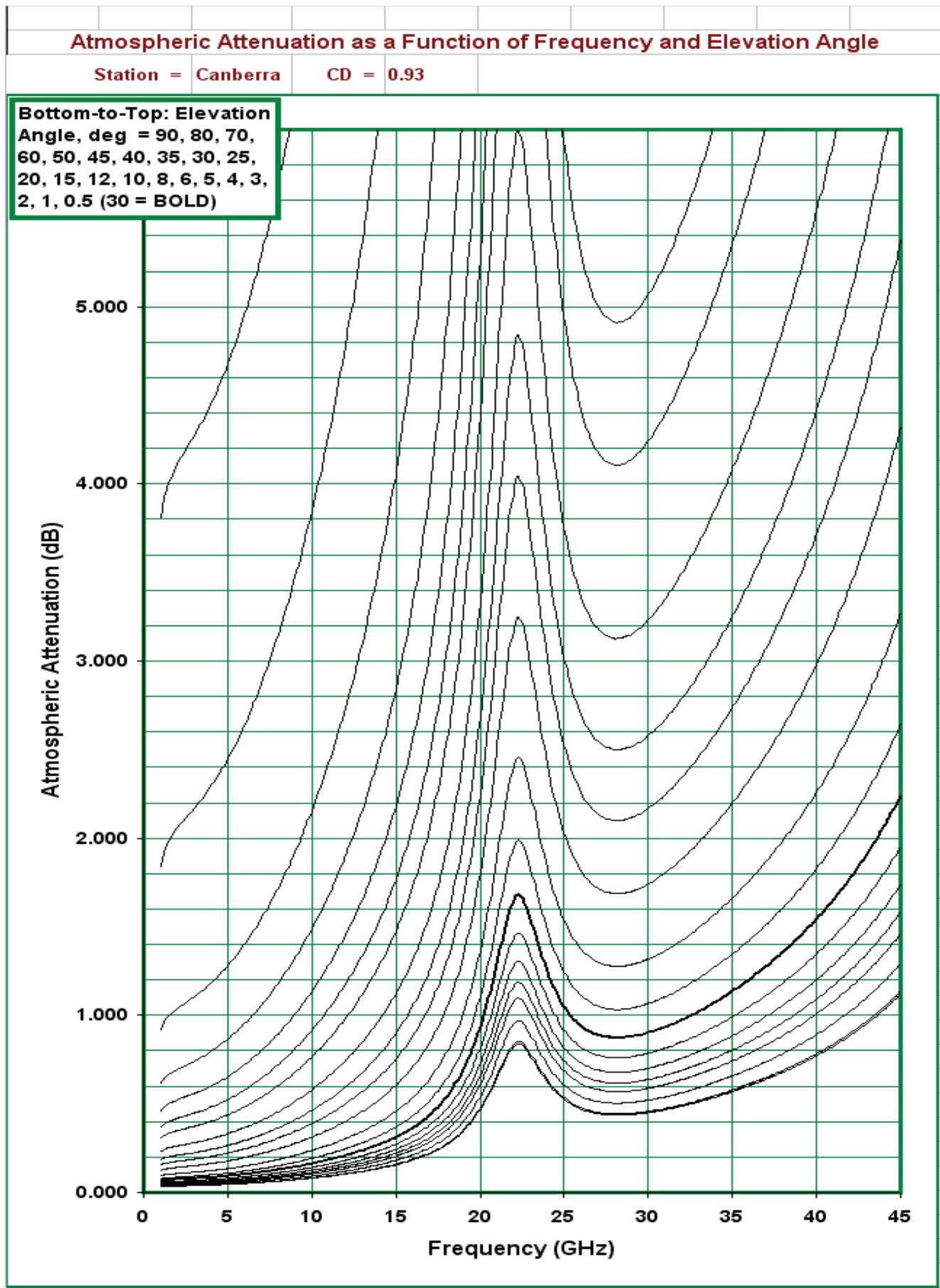
Station = Canberra

CD = 0.92

as a Function of Frequency and Elevation Angle

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)





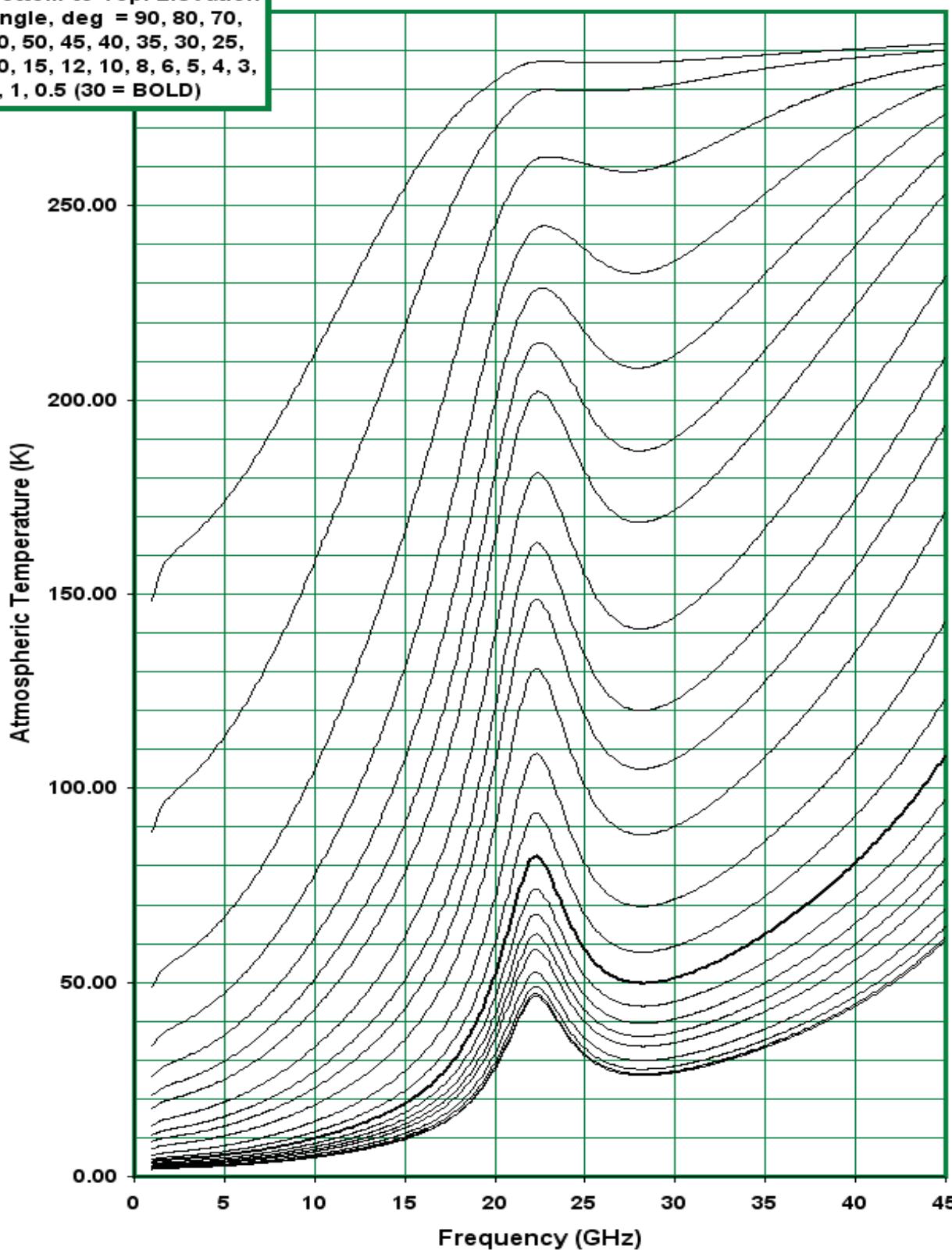
Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

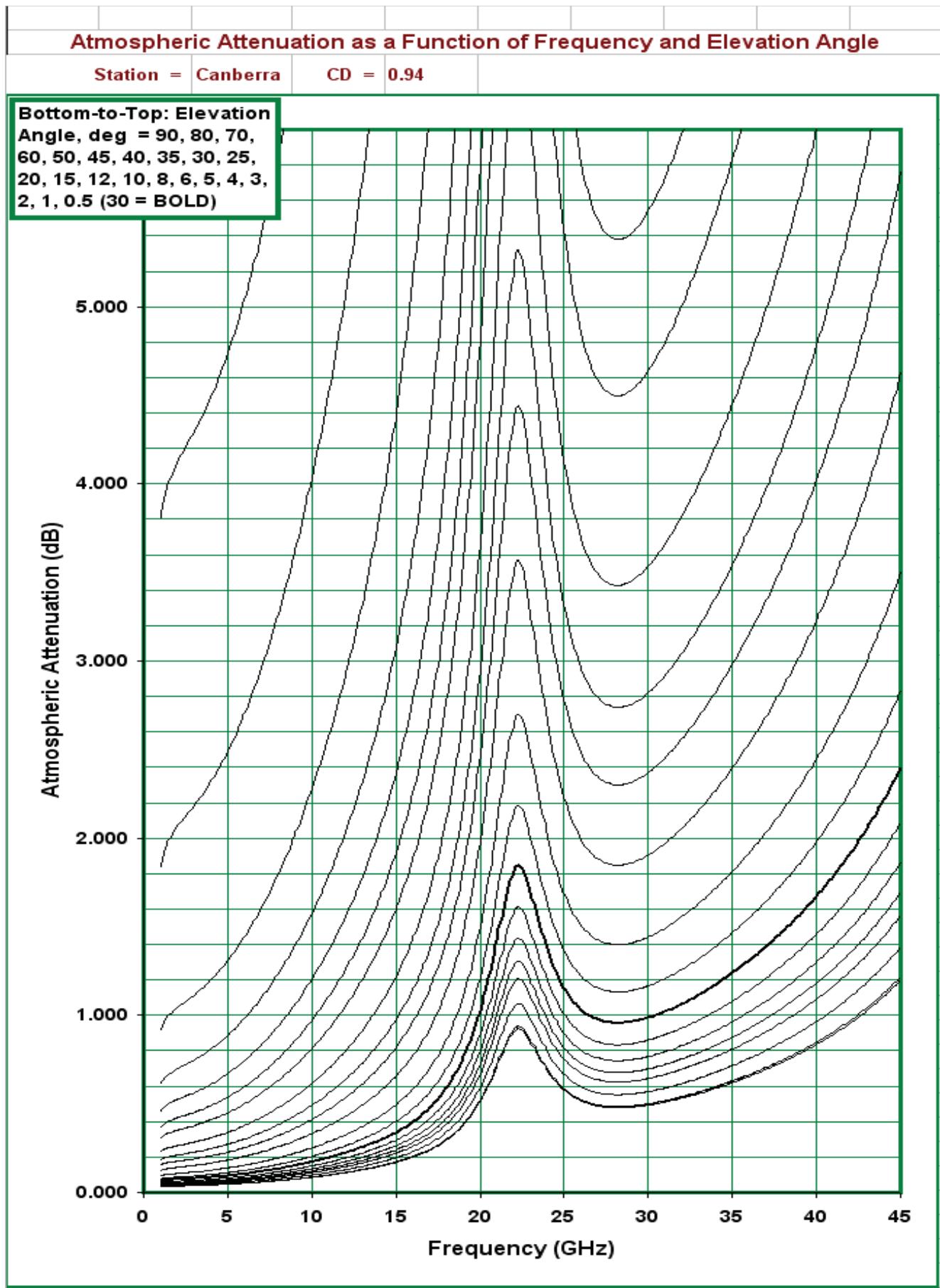
Station = Canberra

CD = 0.93

as a Function of Frequency and Elevation Angle

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)





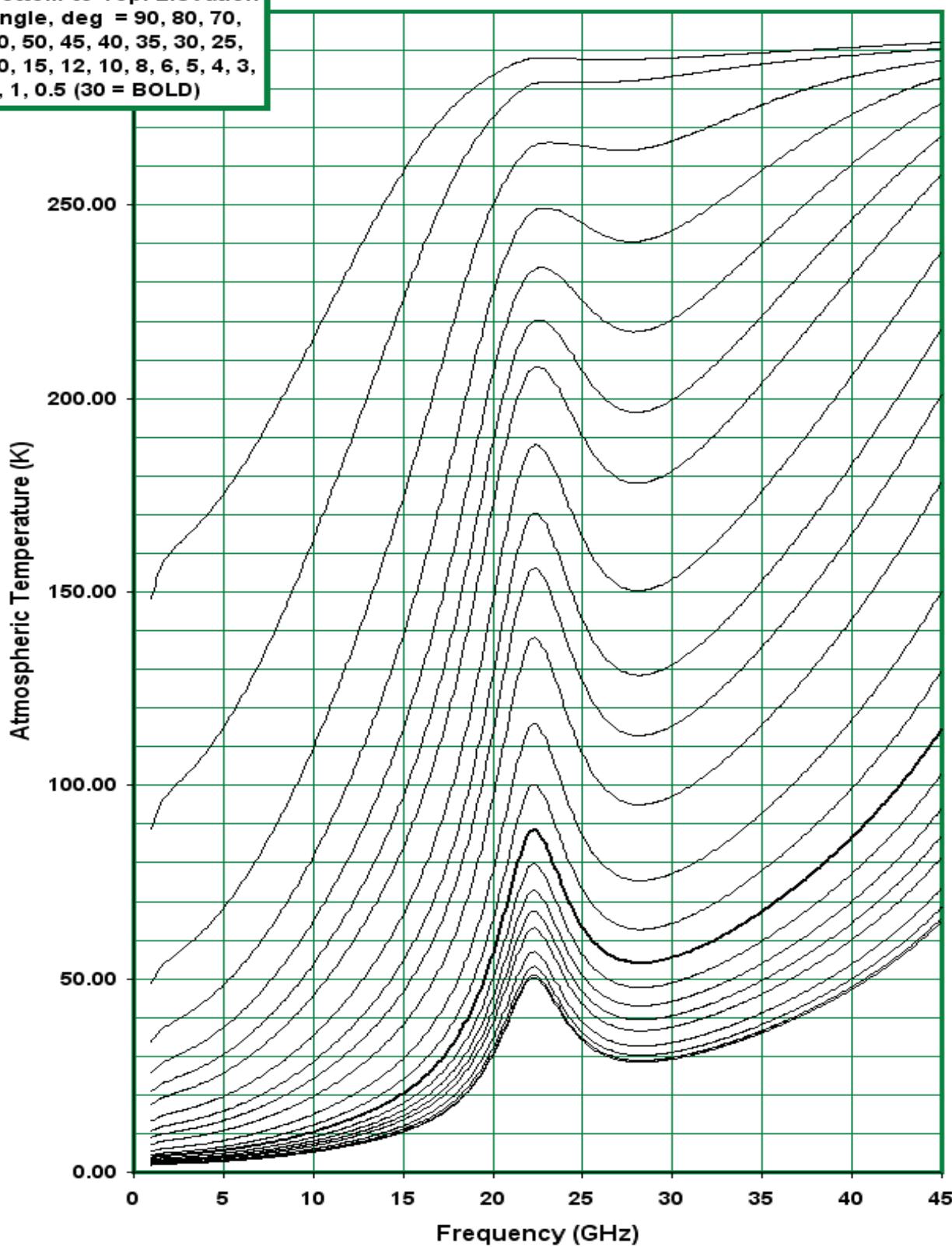
Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

Station = Canberra

CD = 0.94

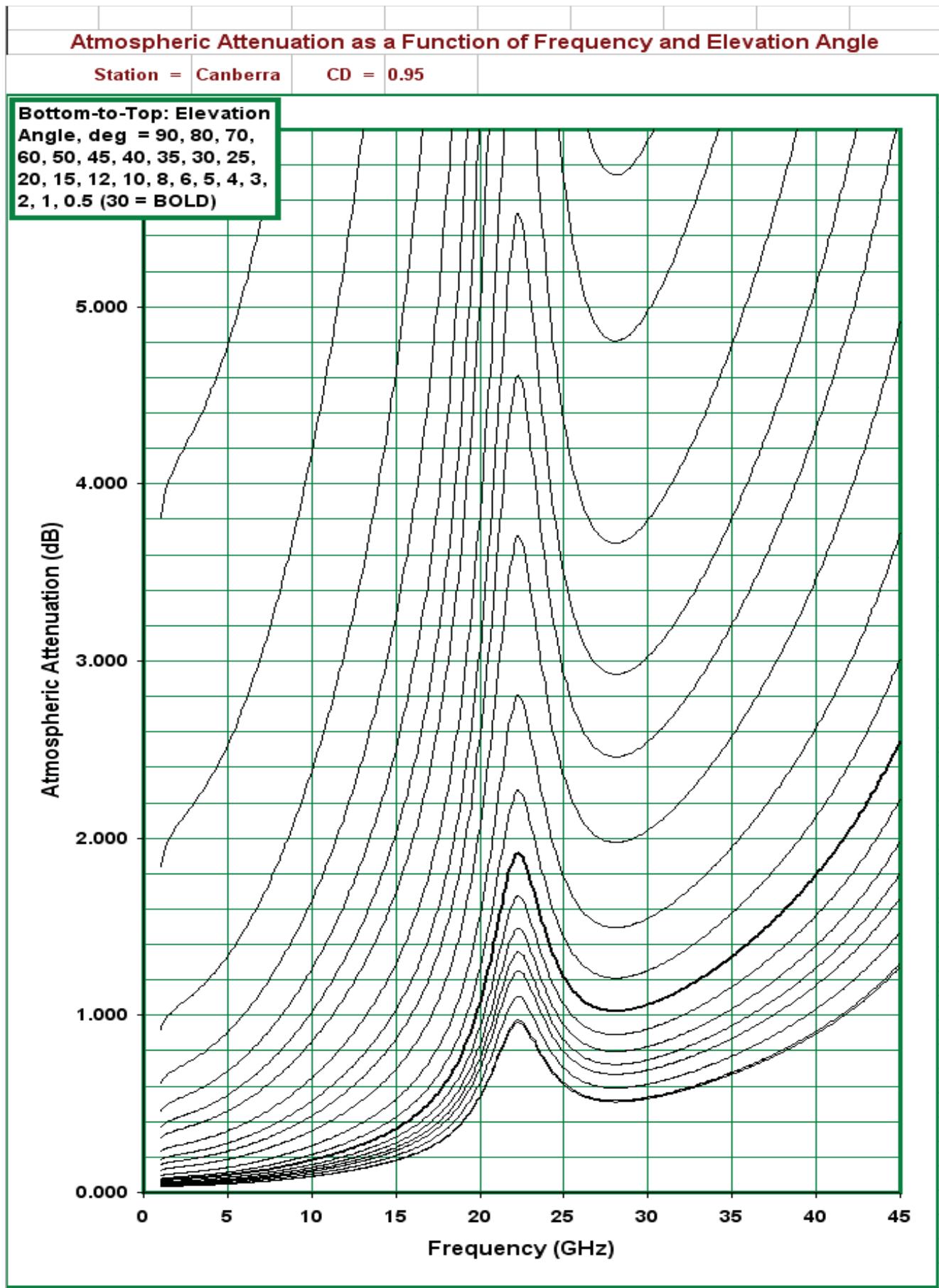
as a Function of Frequency and Elevation Angle

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)



100

Canberra stations atmospheric attenuation and loss



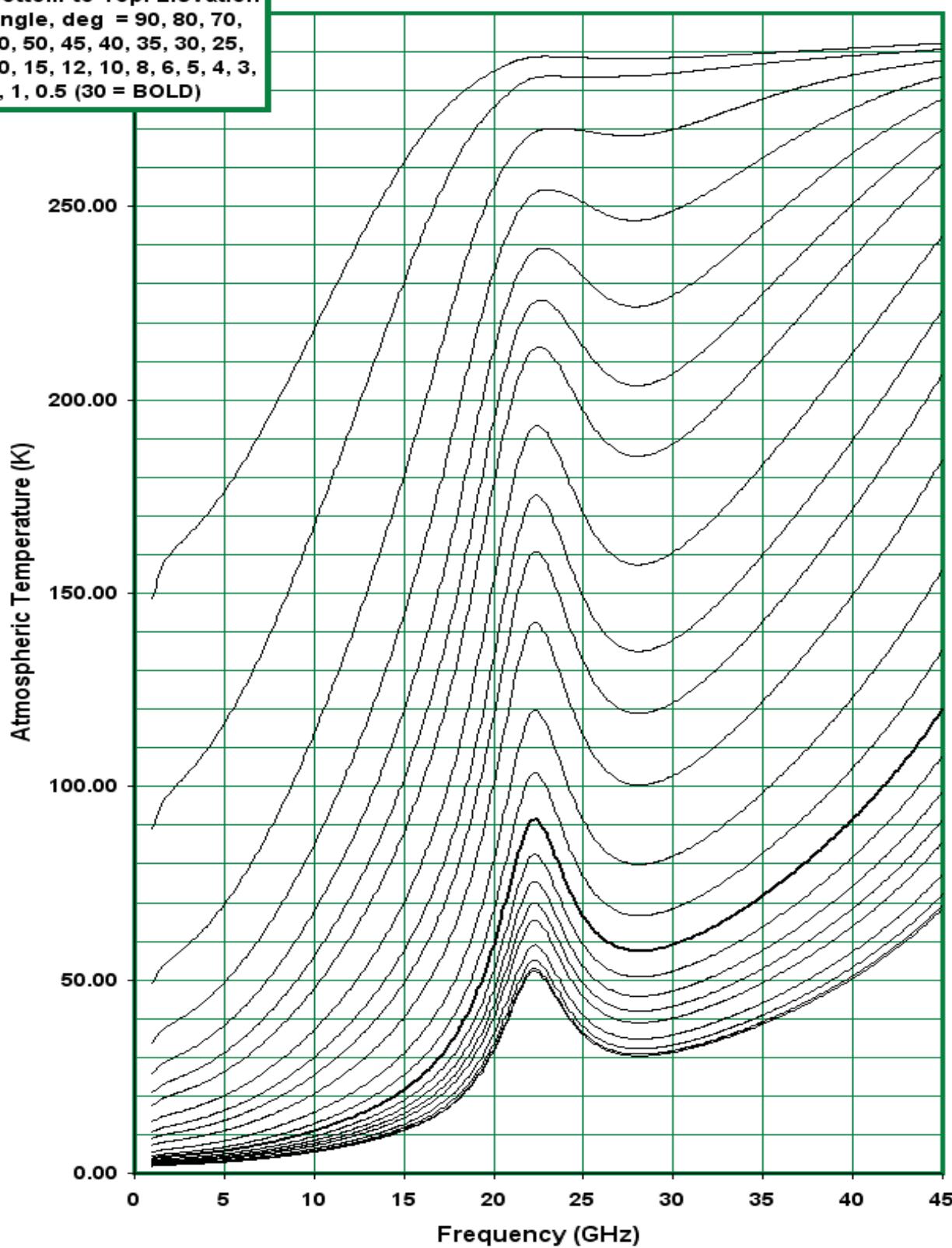
Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

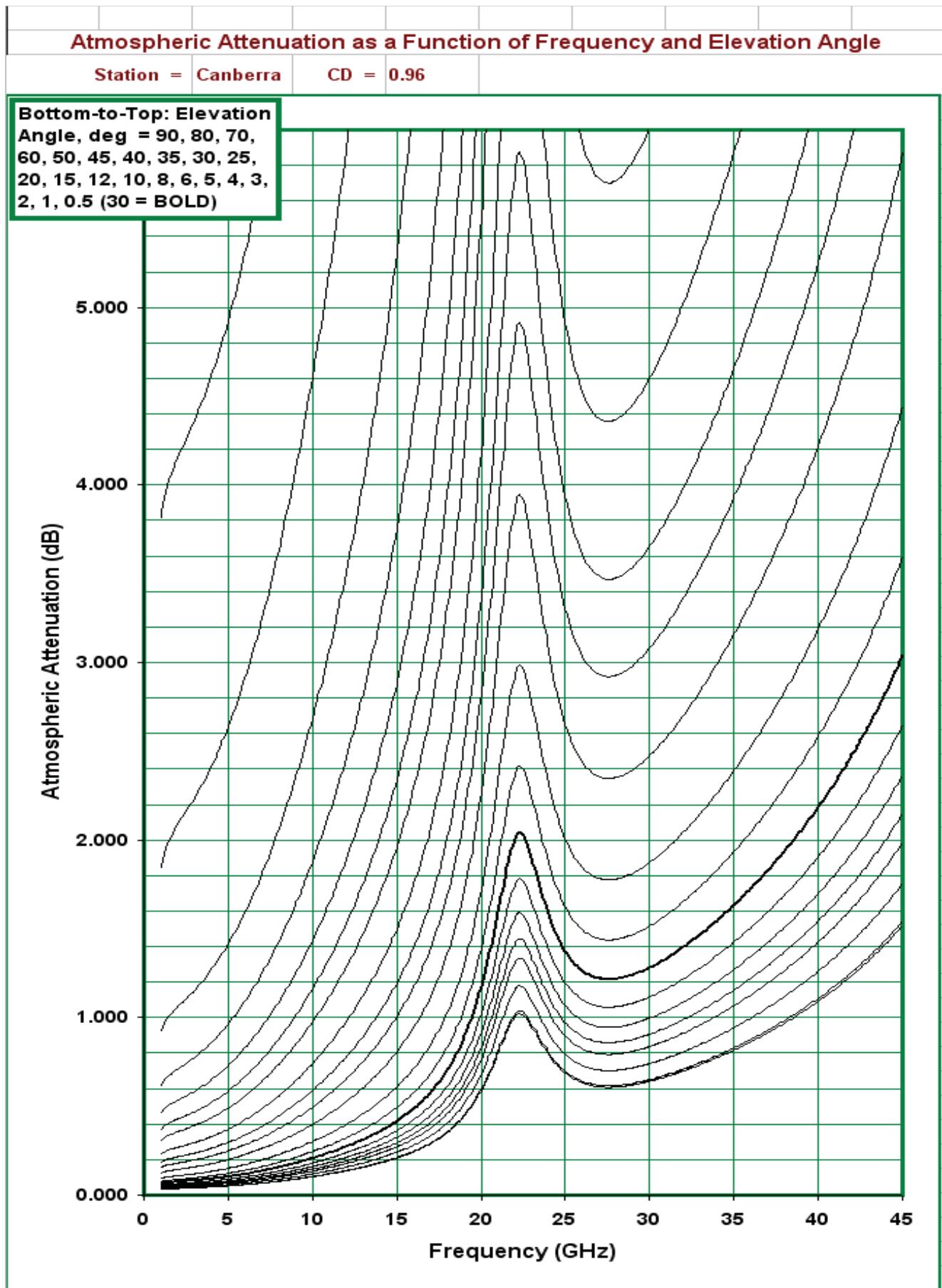
Station = Canberra

CD = 0.95

as a Function of Frequency and Elevation Angle

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)





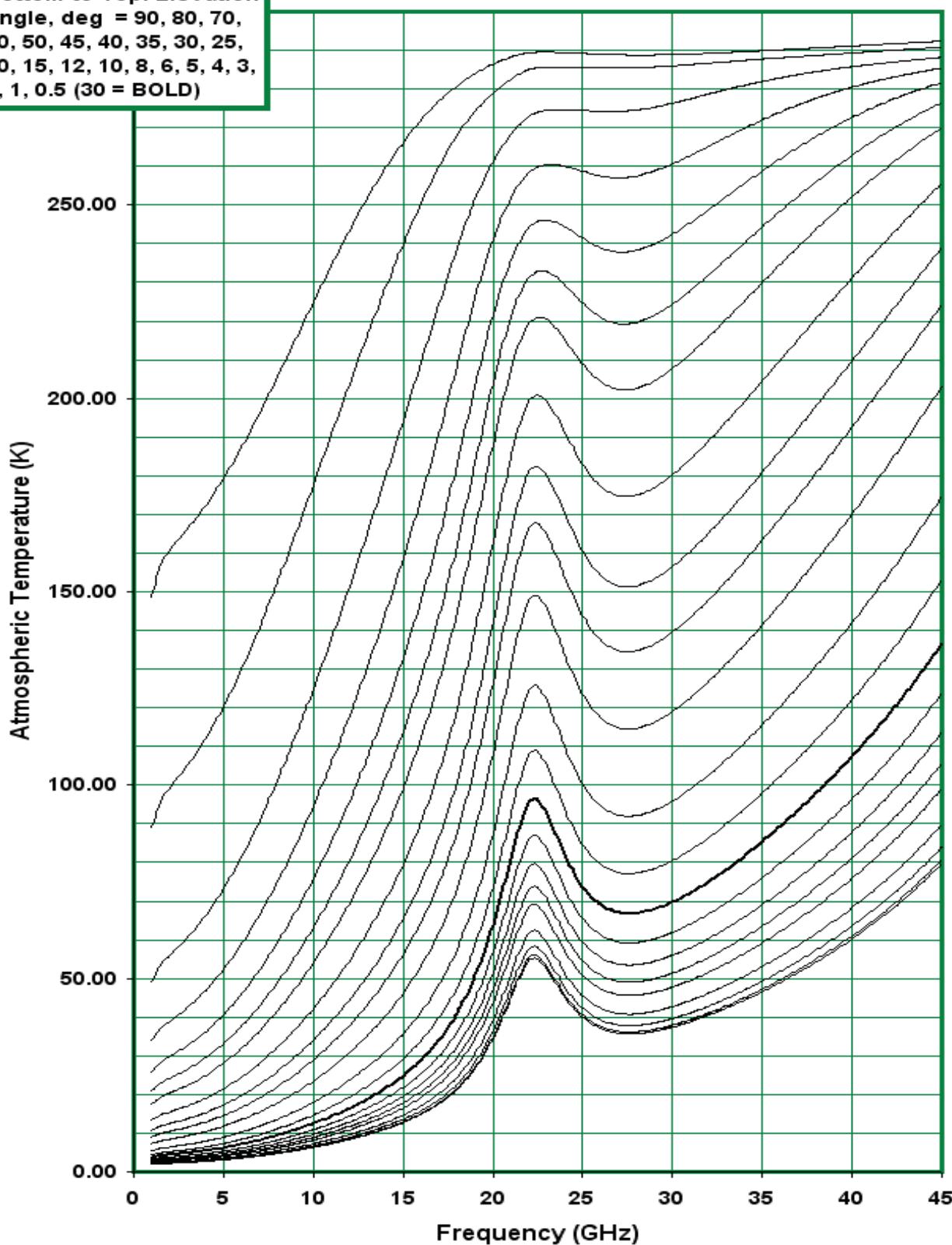
Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

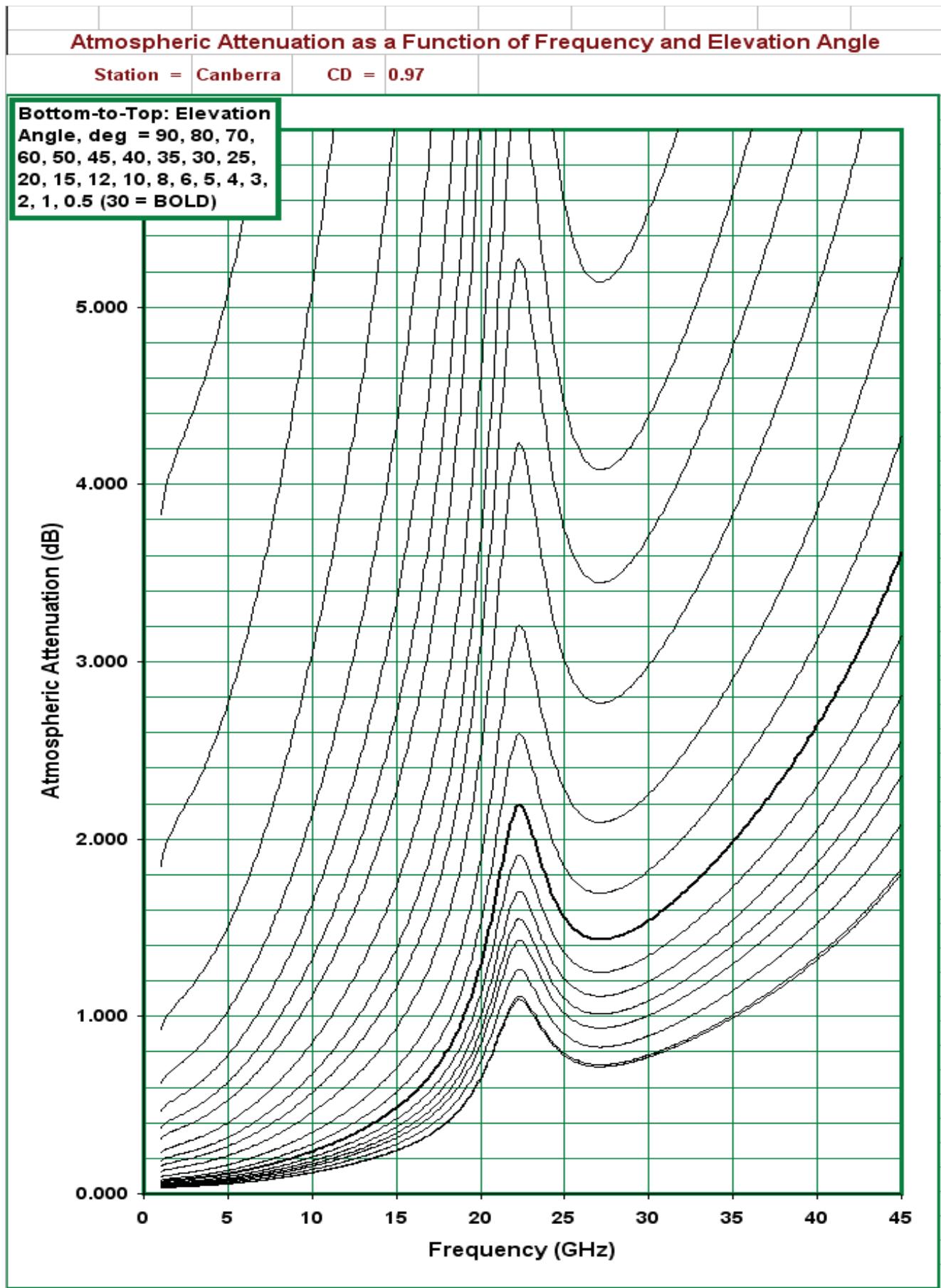
Station = Canberra

CD = 0.96

as a Function of Frequency and Elevation Angle

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)





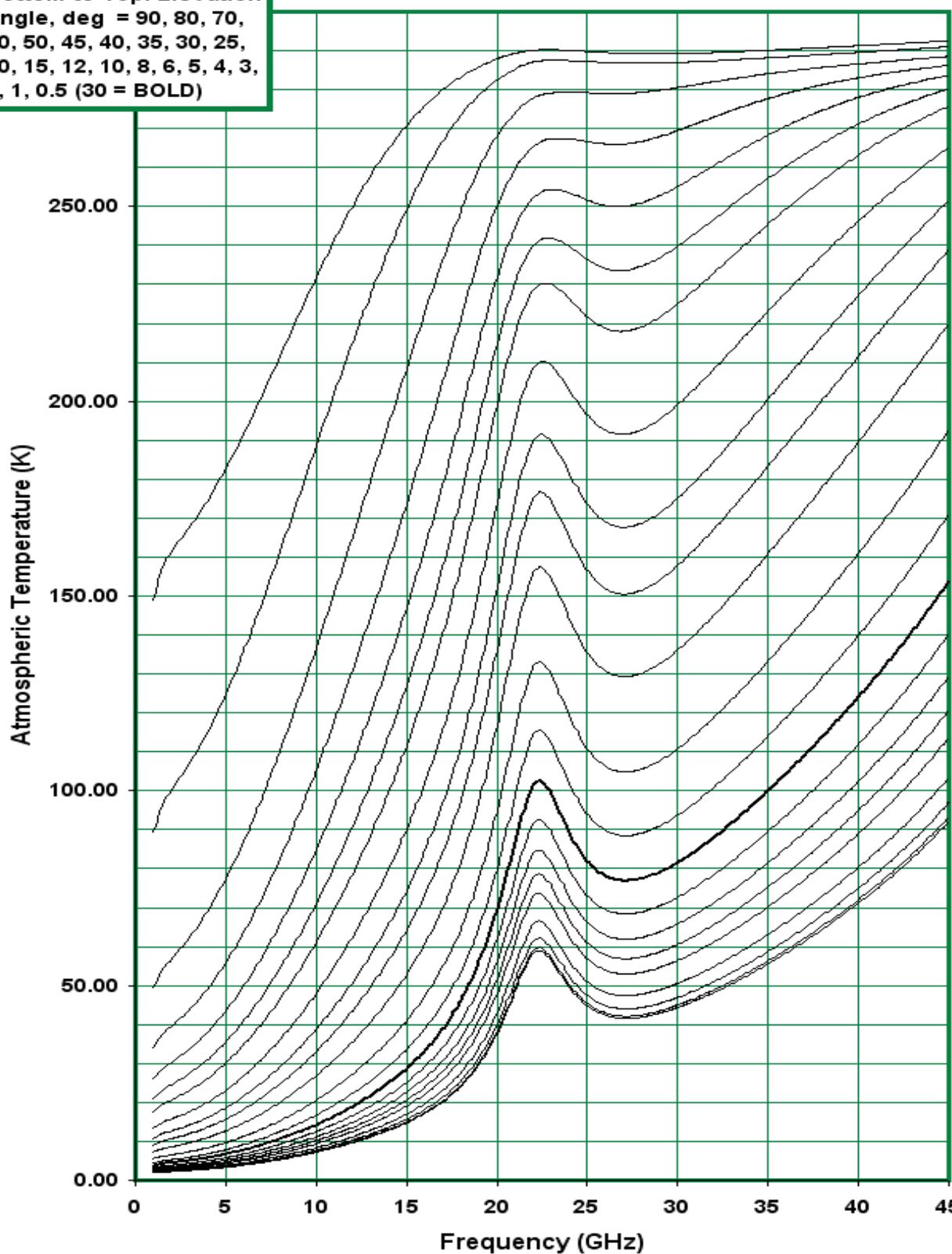
Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

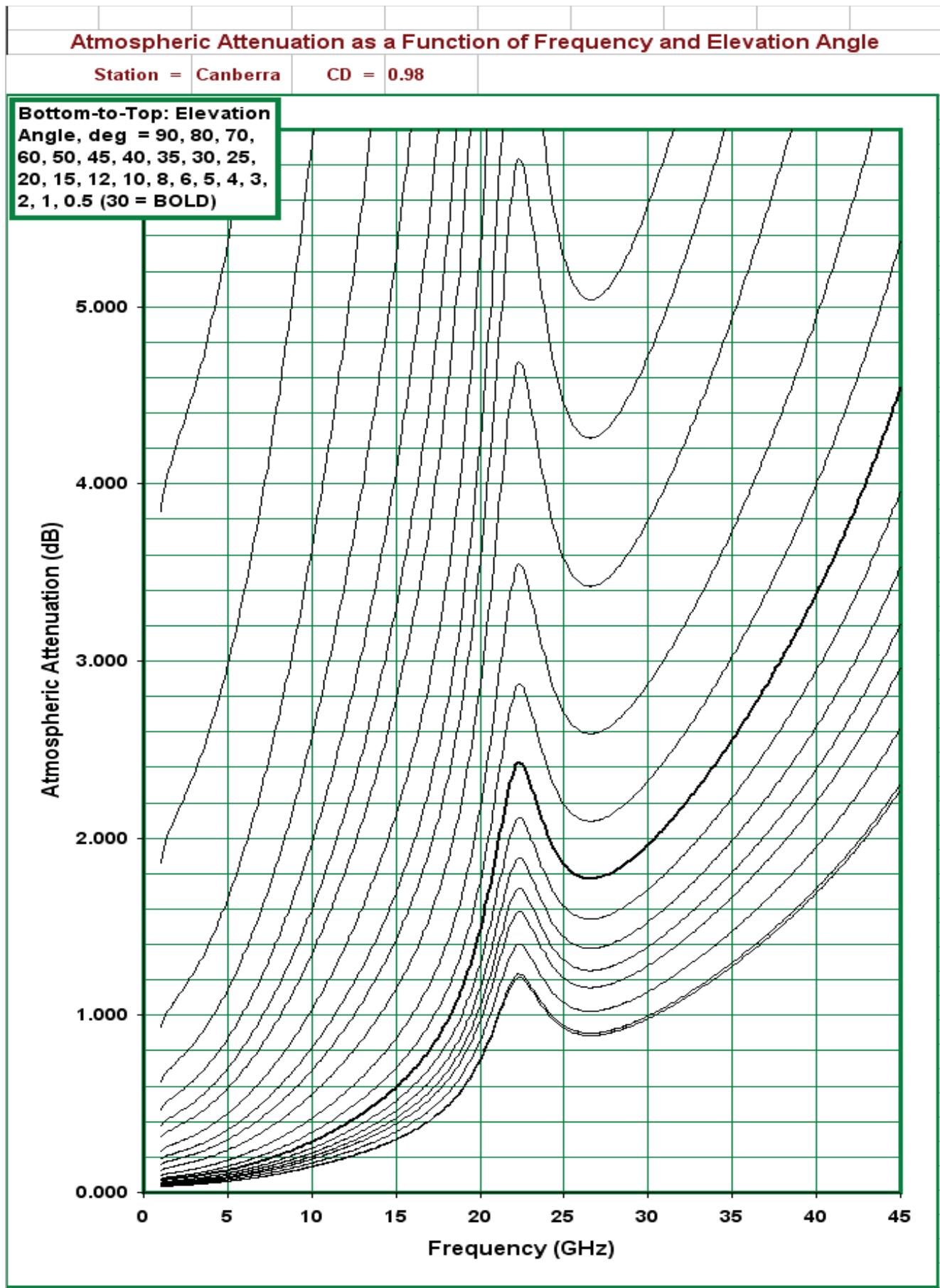
Station = Canberra

CD = 0.97

as a Function of Frequency and Elevation Angle

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)





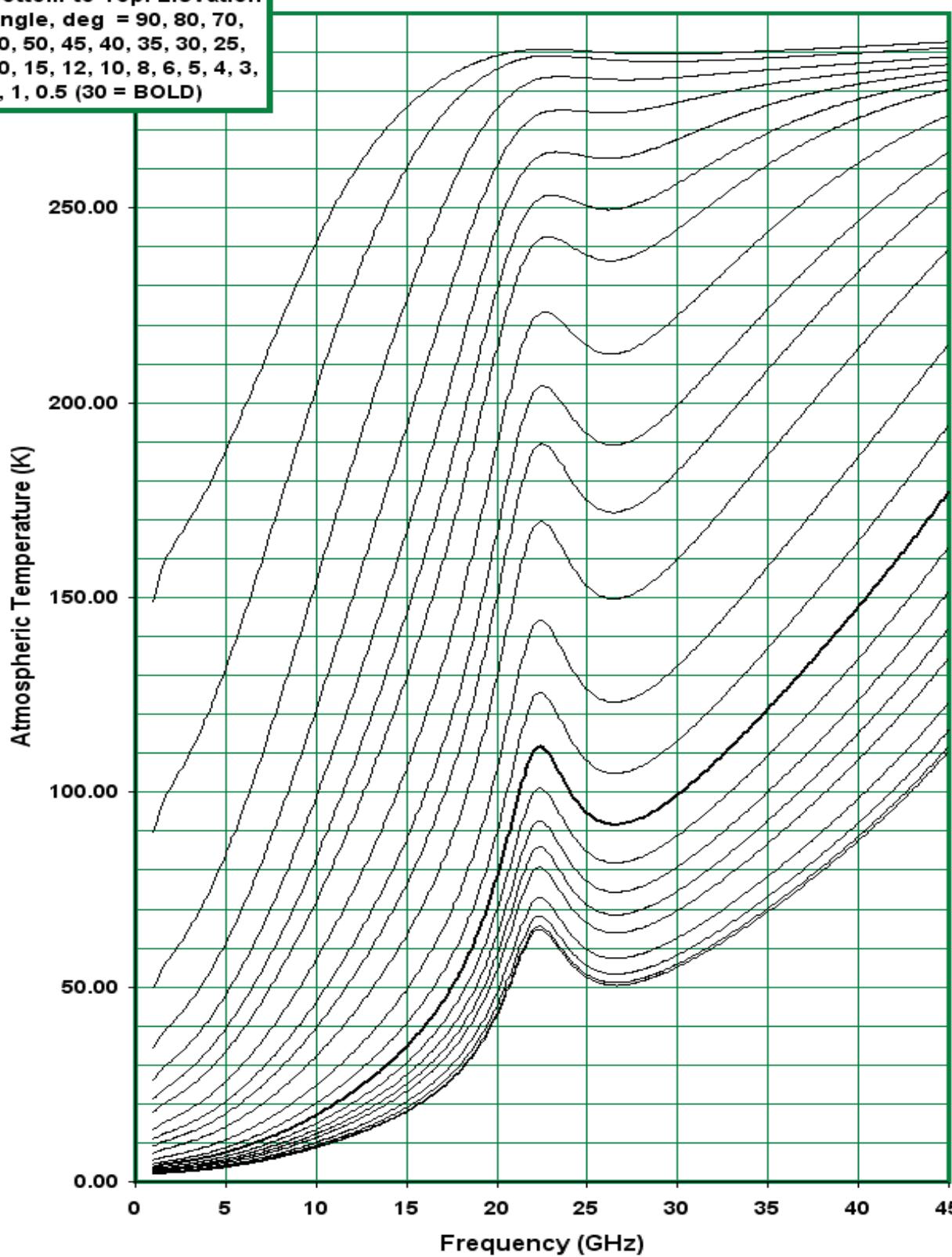
Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

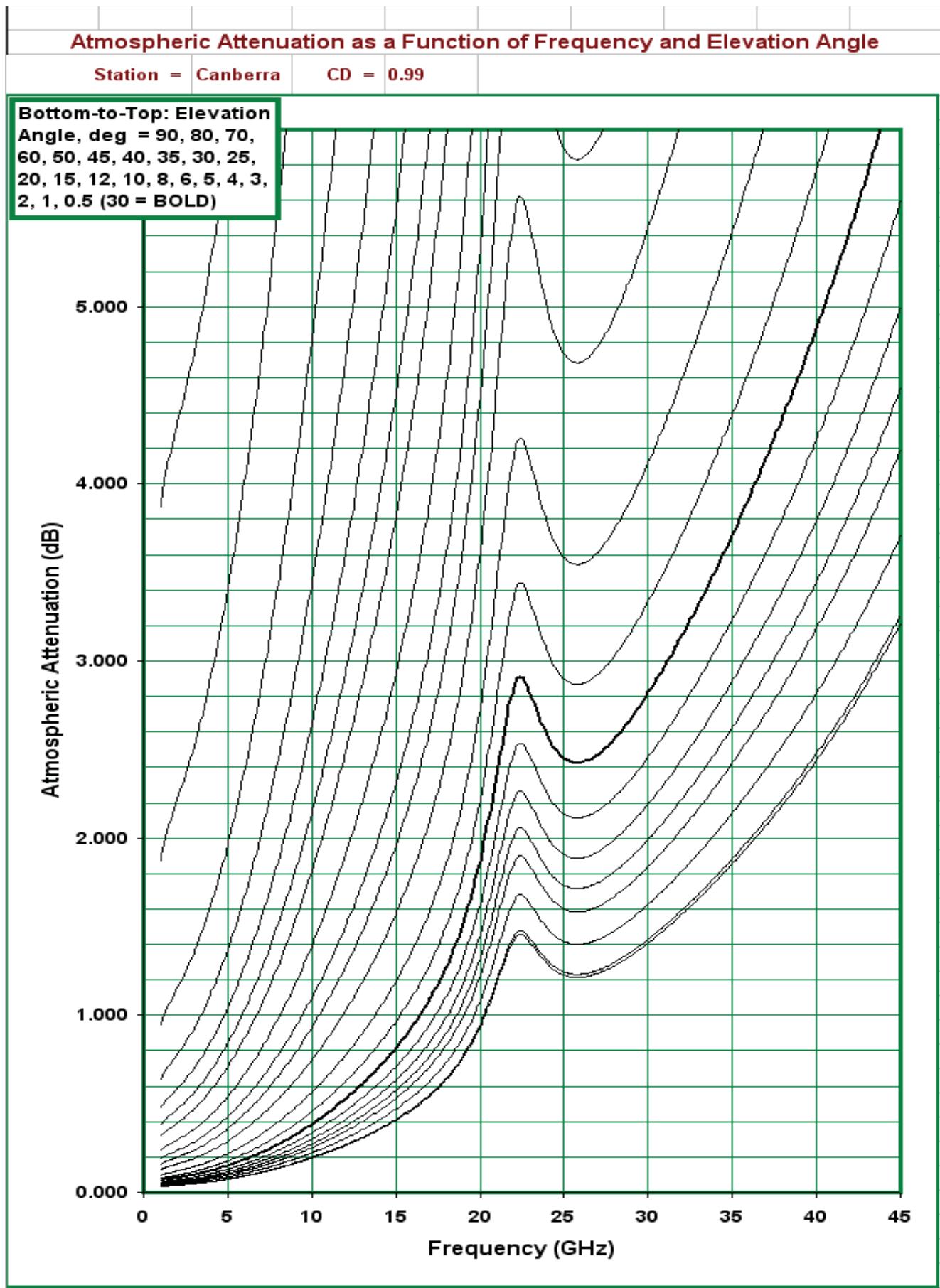
Station = Canberra

CD = 0.98

as a Function of Frequency and Elevation Angle

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)





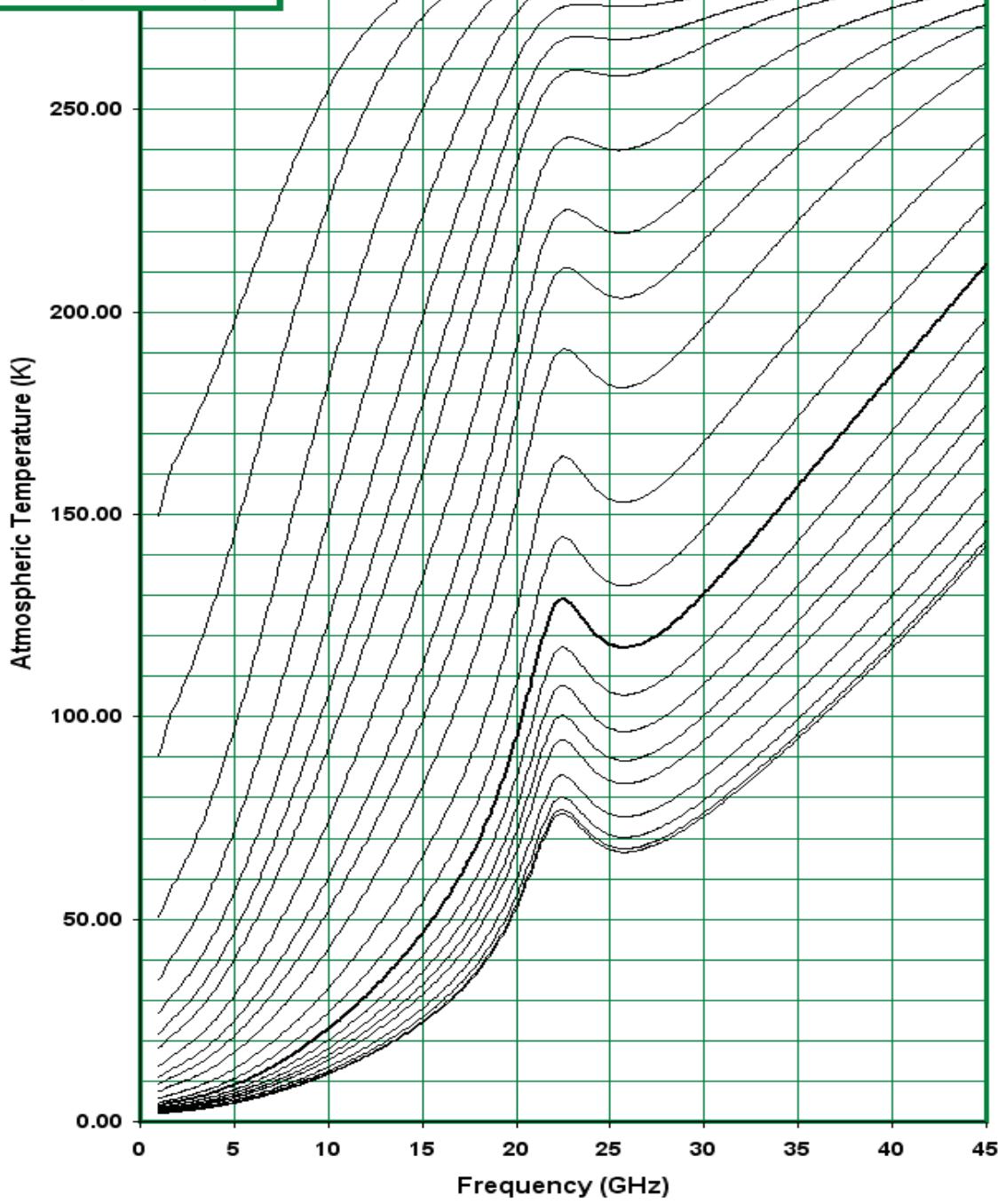
Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

Station = Canberra

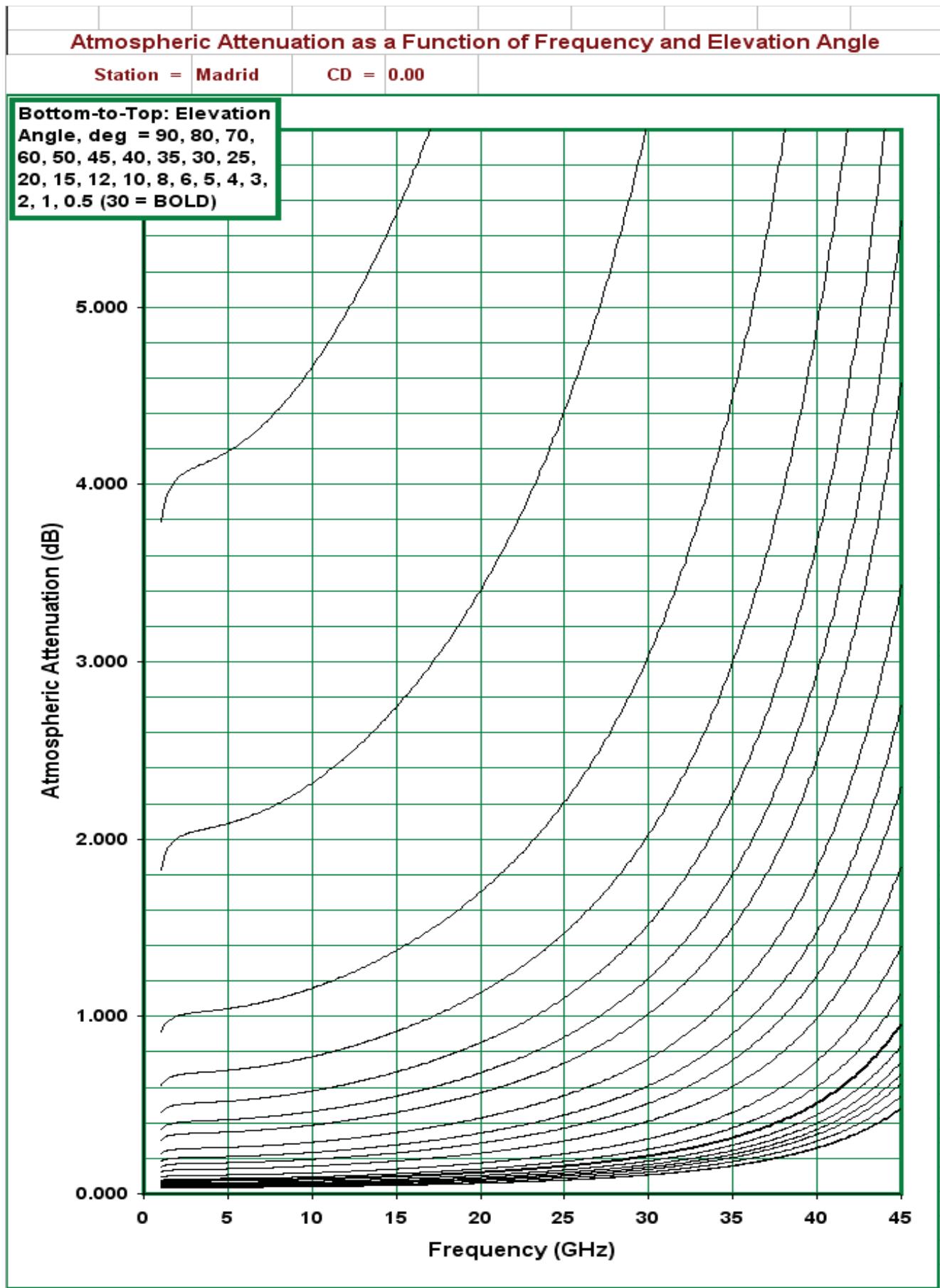
CD = 0.99

as a Function of Frequency and Elevation Angle

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)



Madrid Stations



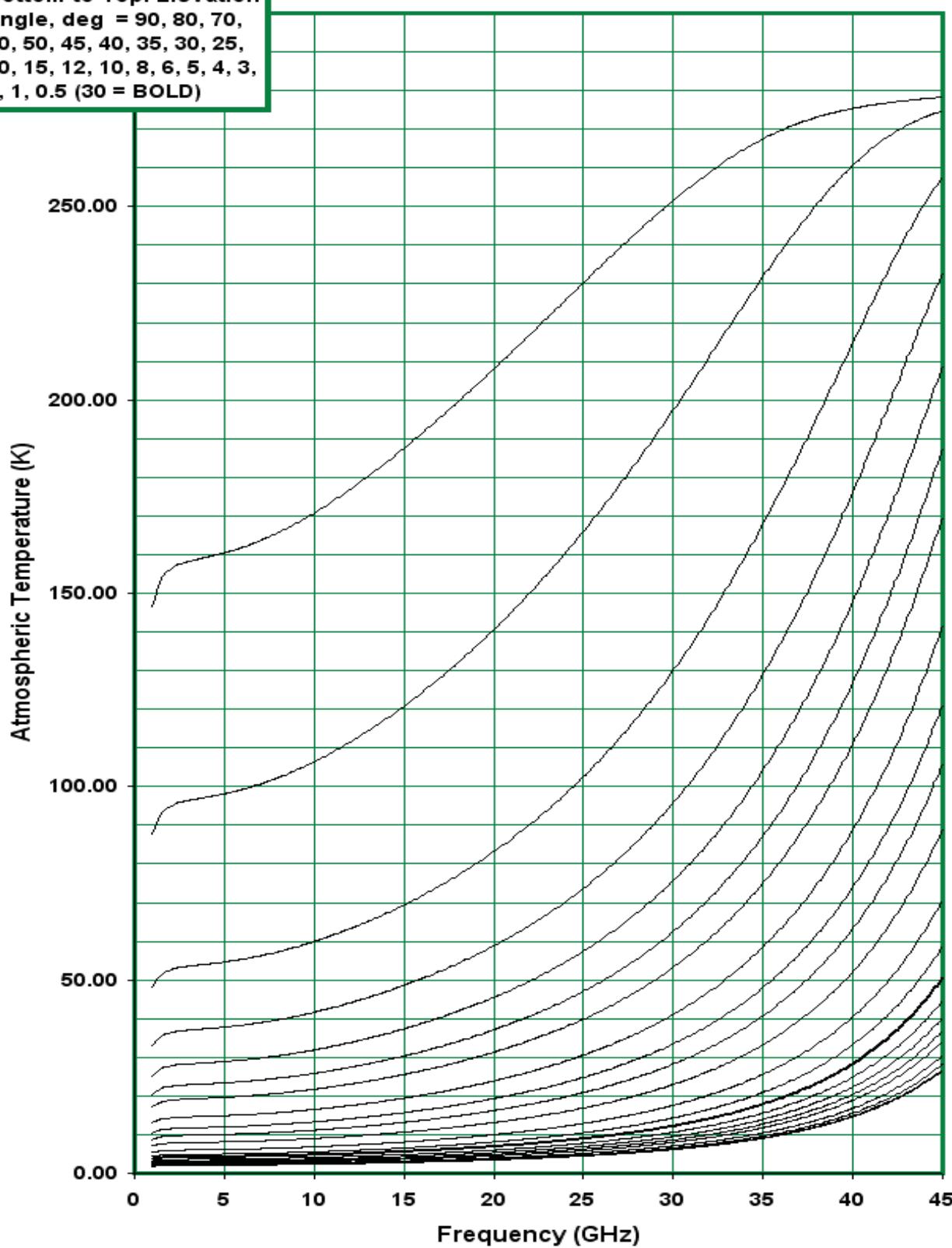
Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

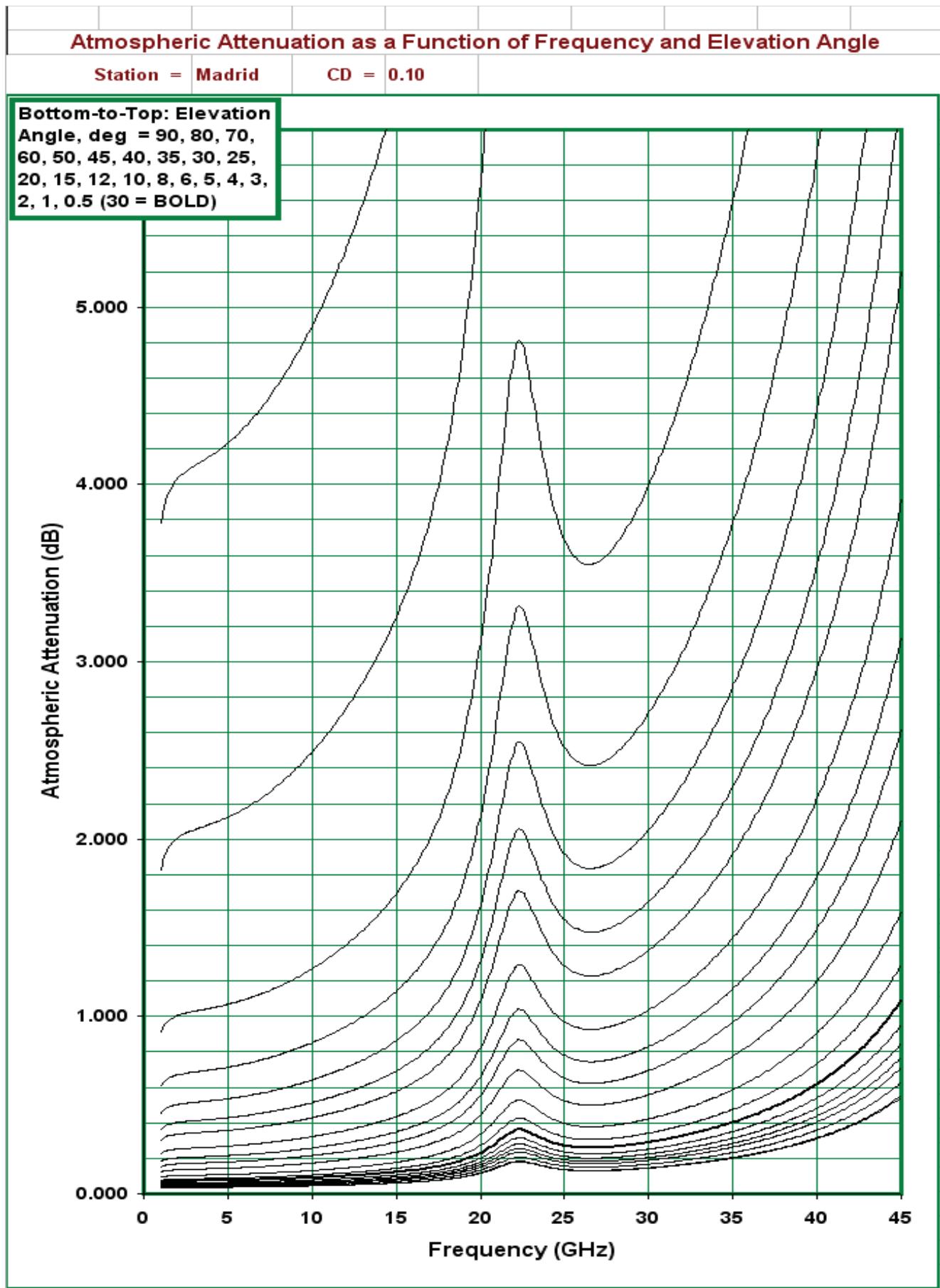
Station = Madrid

CD = 0.00

as a Function of Frequency and Elevation Angle

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)





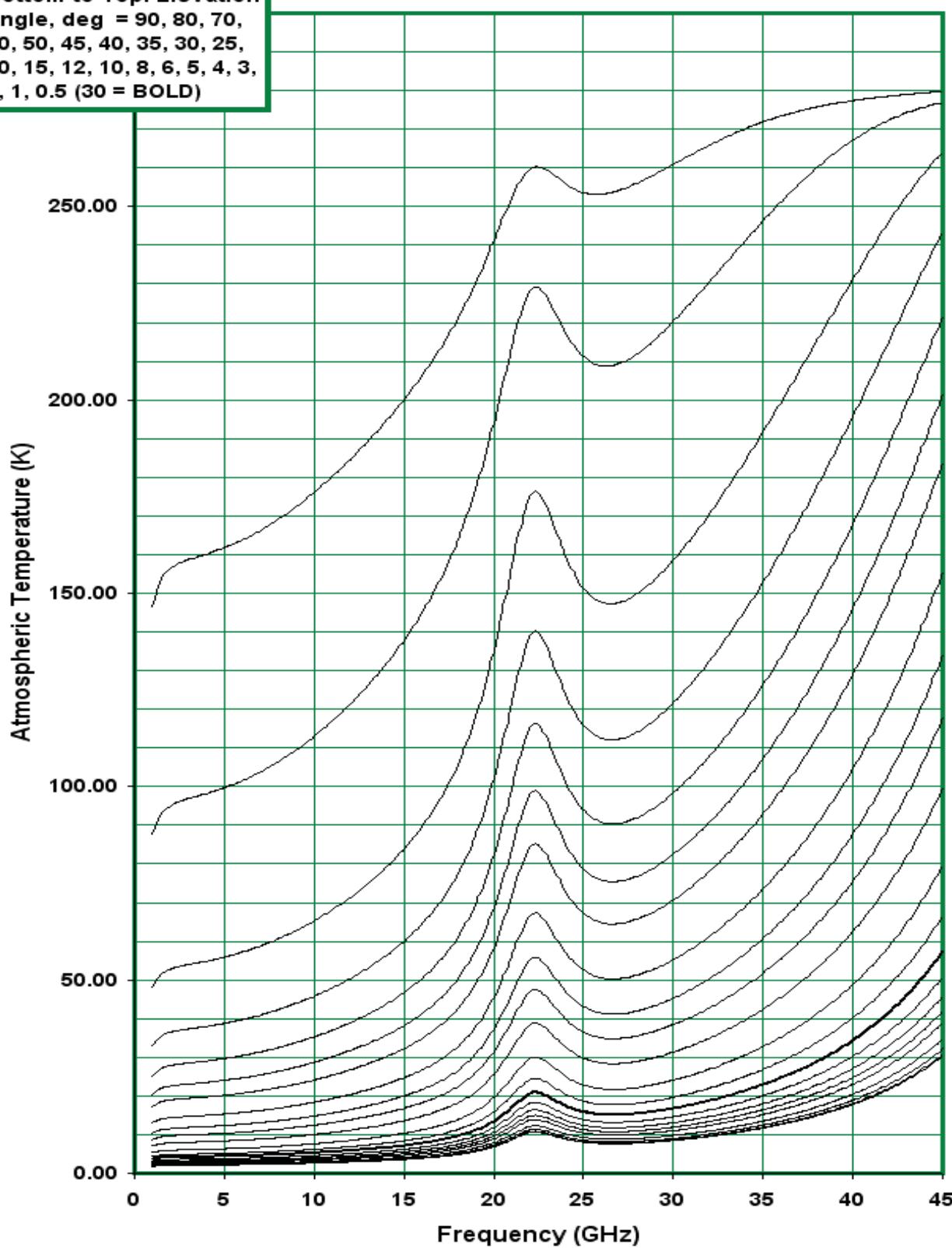
Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

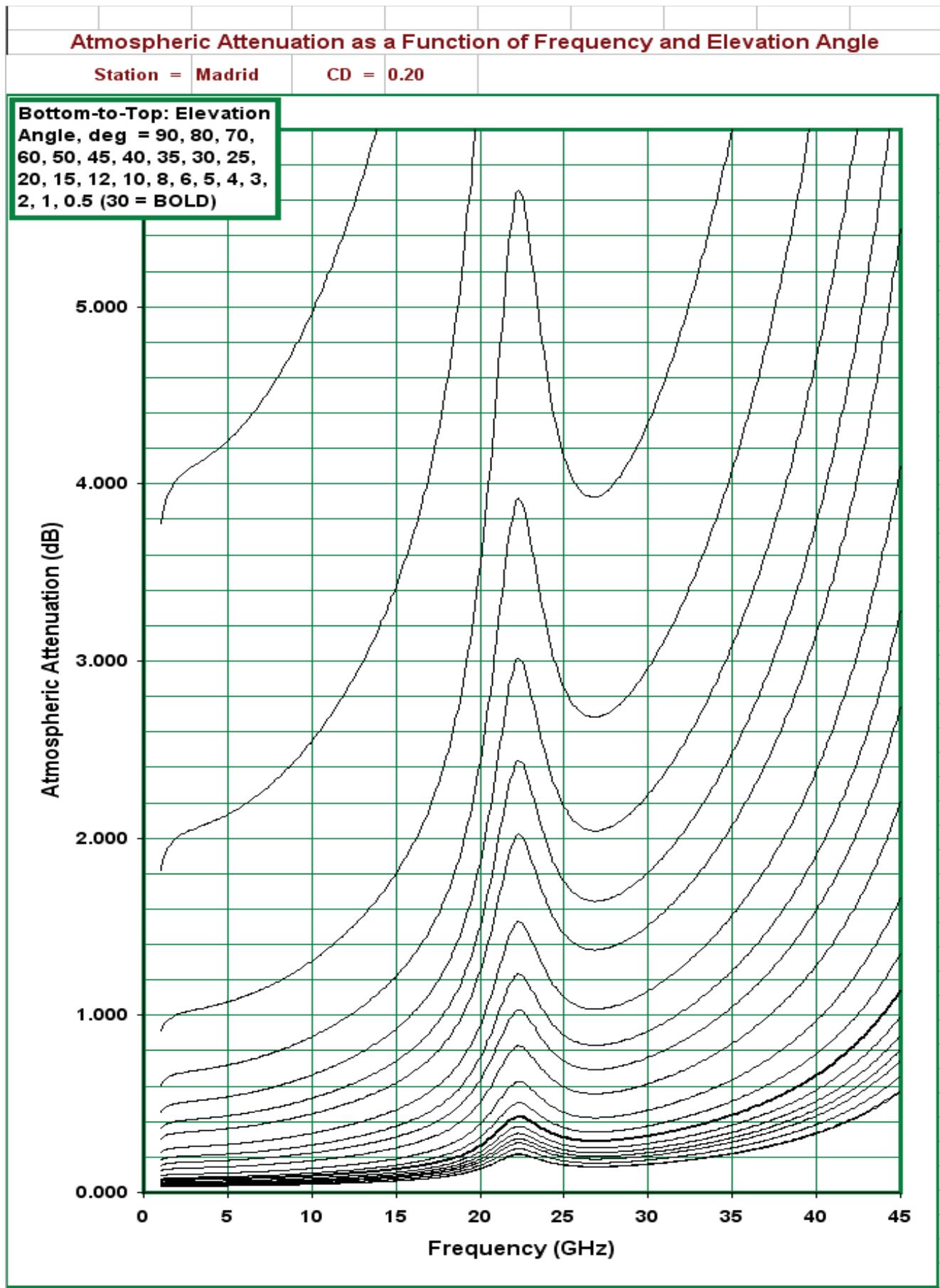
Station = Madrid

CD = 0.10

as a Function of Frequency and Elevation Angle

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)





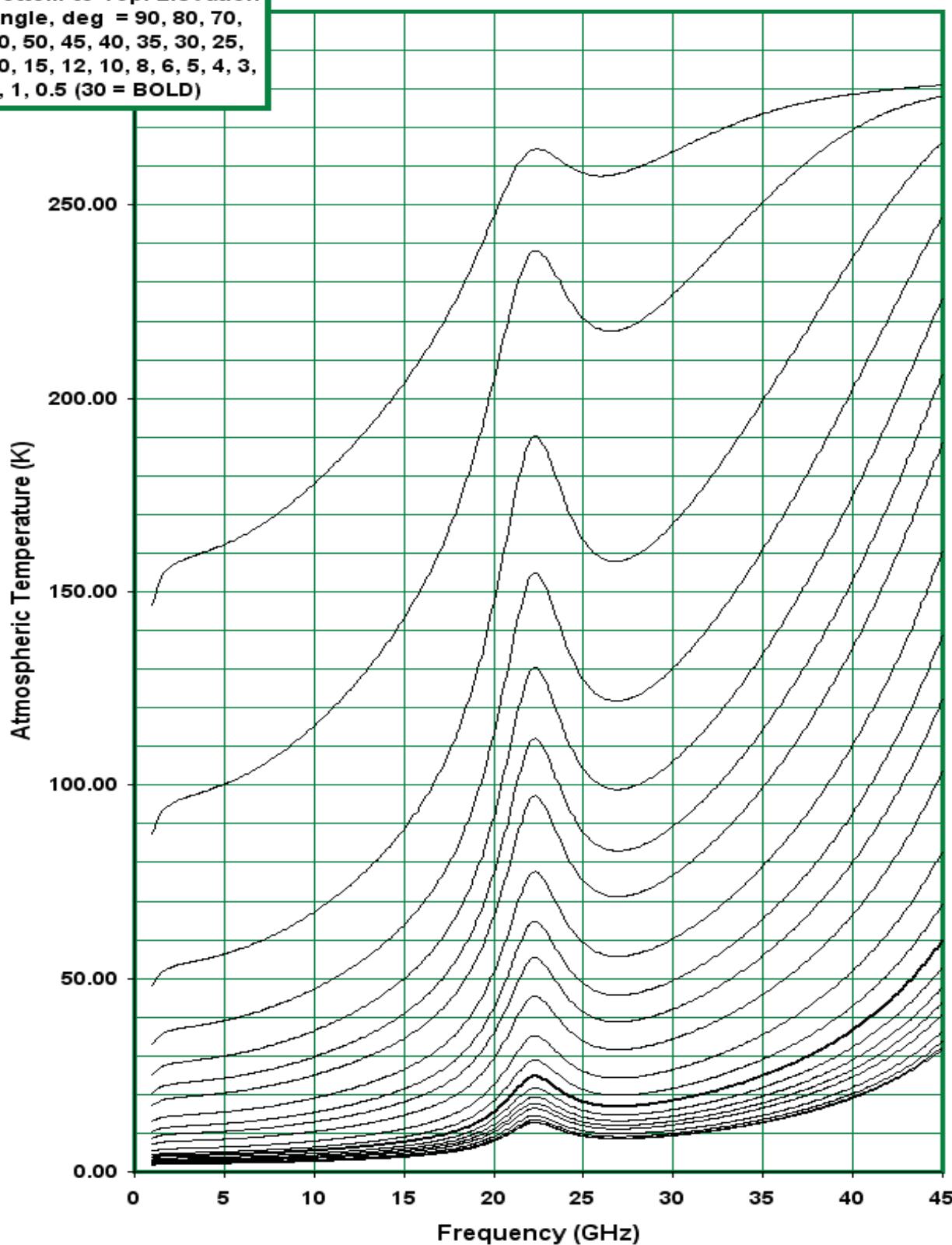
Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

Station = Madrid

CD = 0.20

as a Function of Frequency and Elevation Angle

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)



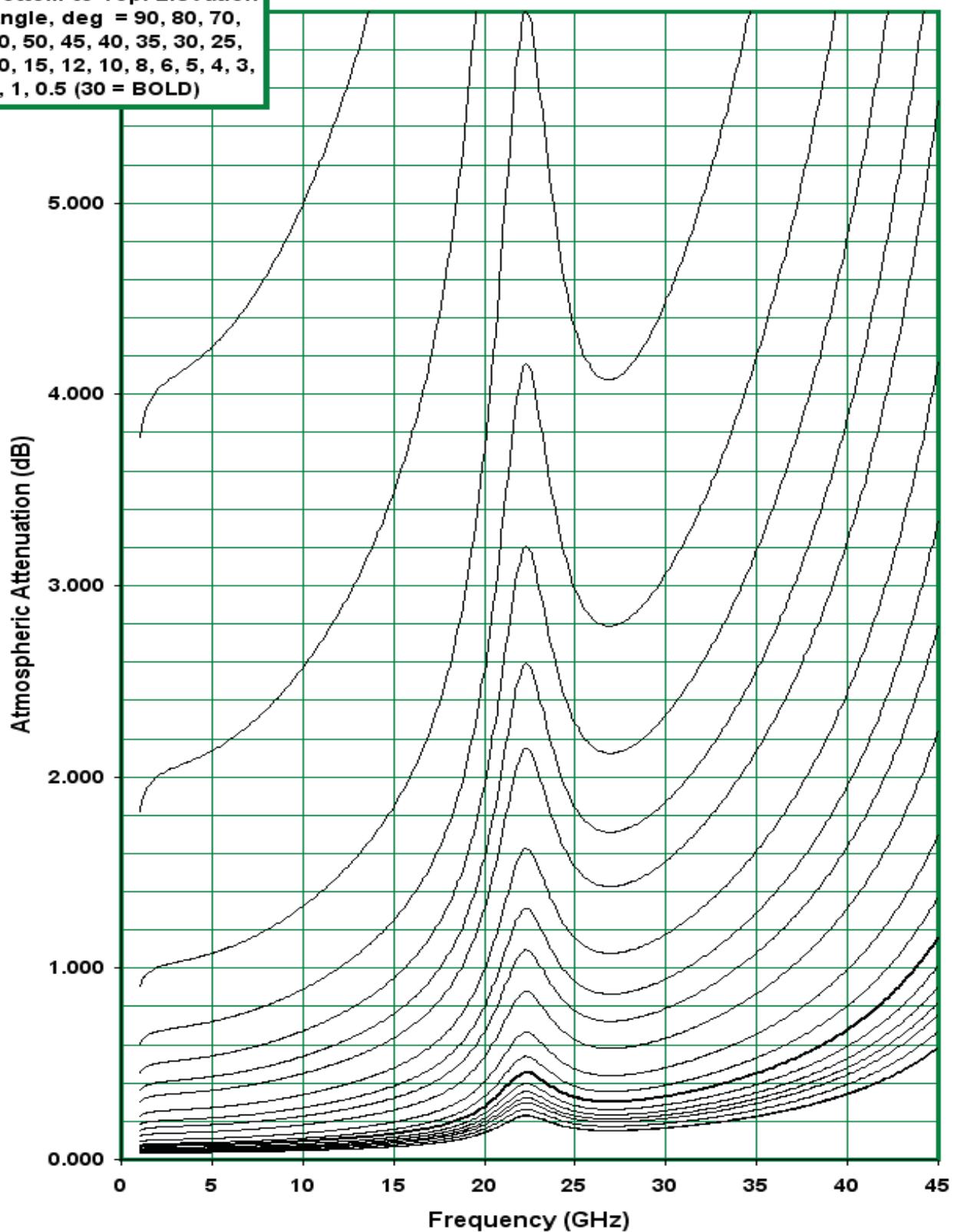
Atmospheric Attenuation as a Function of Frequency and Elevation Angle

Station = Madrid

CD = 0.25

Bottom-to-Top: Elevation

Angle, deg = 90, 80, 70,
60, 50, 45, 40, 35, 30, 25,
20, 15, 12, 10, 8, 6, 5, 4, 3,
2, 1, 0.5 (30 = BOLD)



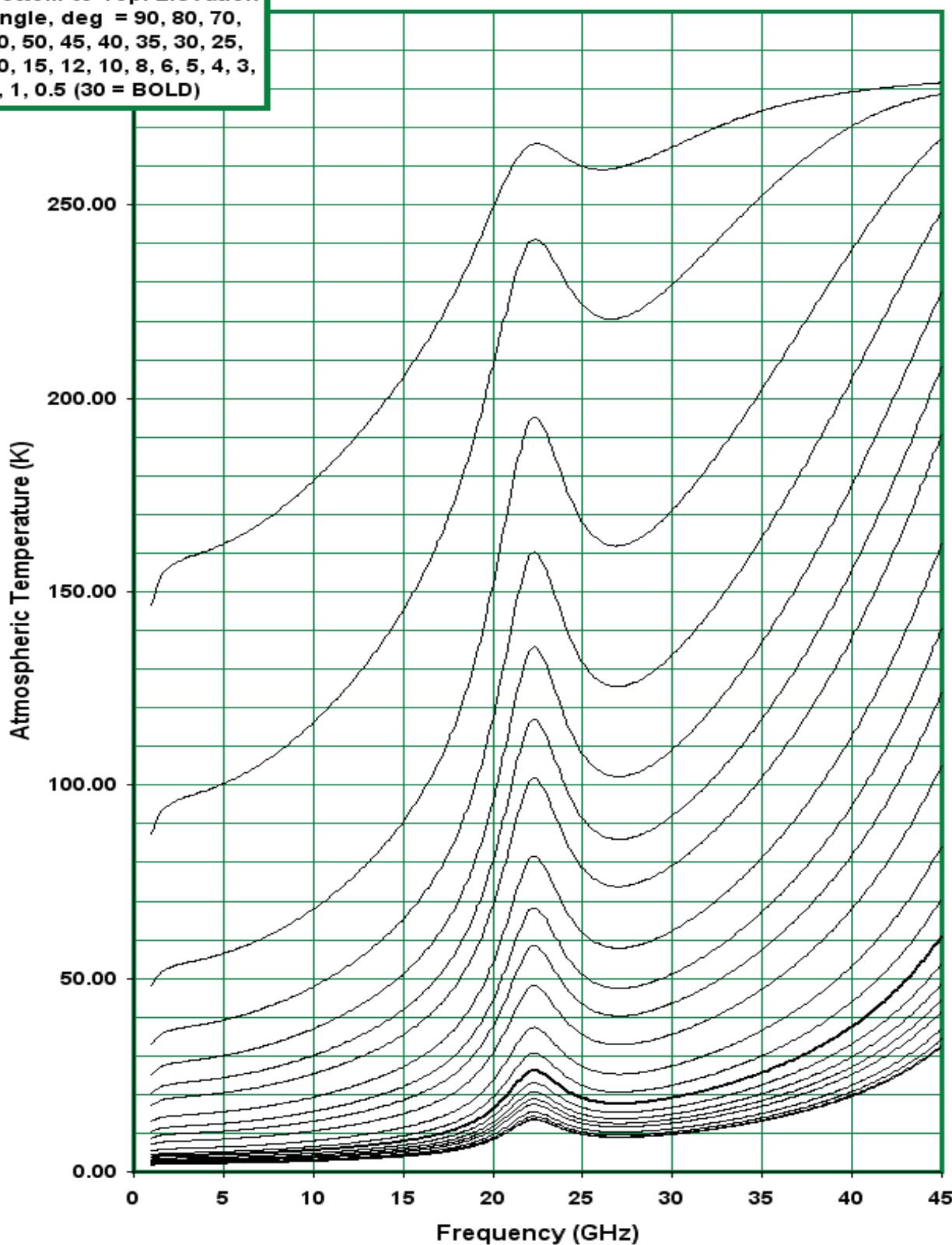
Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

Station = Madrid

CD = 0.25

as a Function of Frequency and Elevation Angle

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)

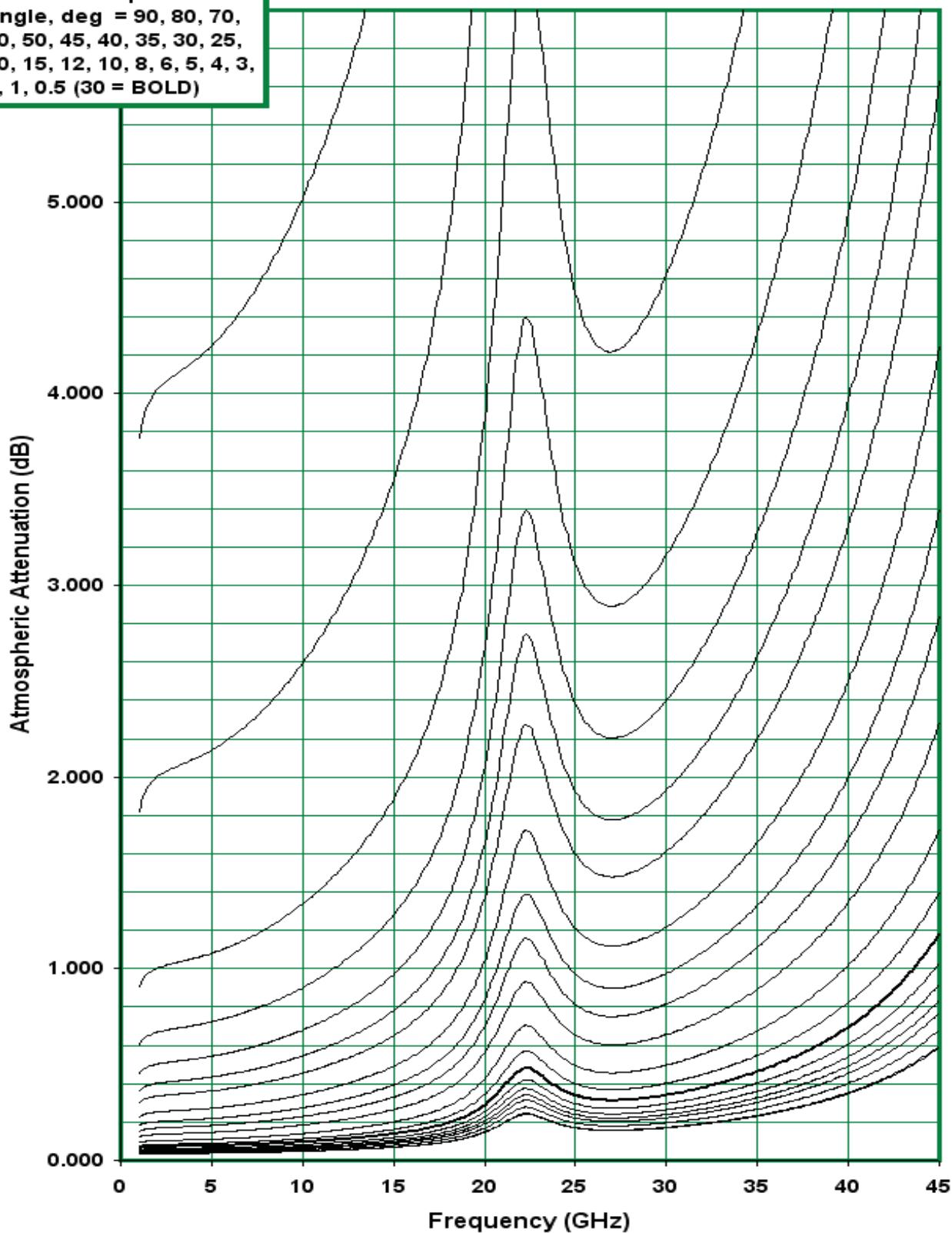


Atmospheric Attenuation as a Function of Frequency and Elevation Angle

Station = Madrid

CD = 0.30

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)



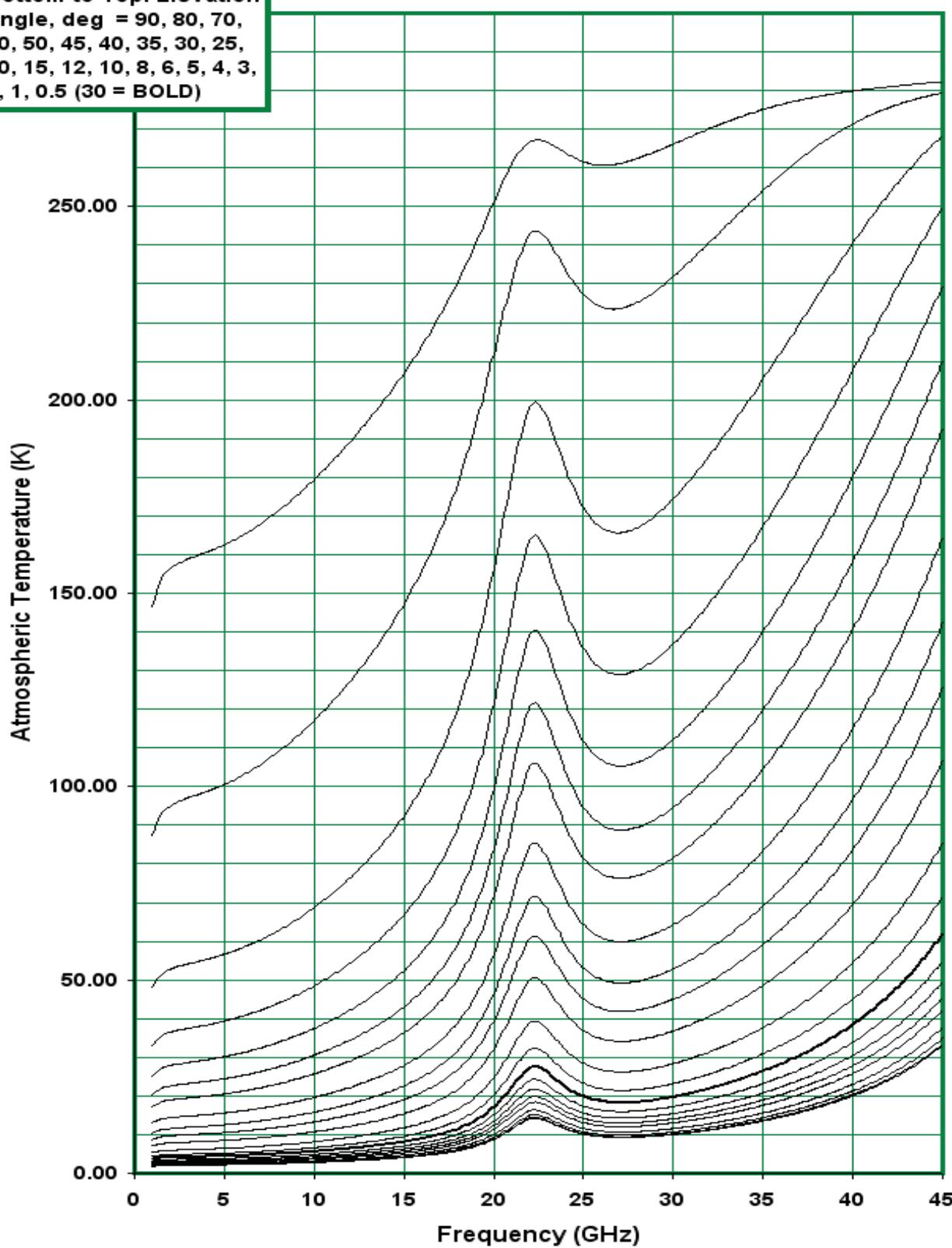
Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

Station = Madrid

CD = 0.30

as a Function of Frequency and Elevation Angle

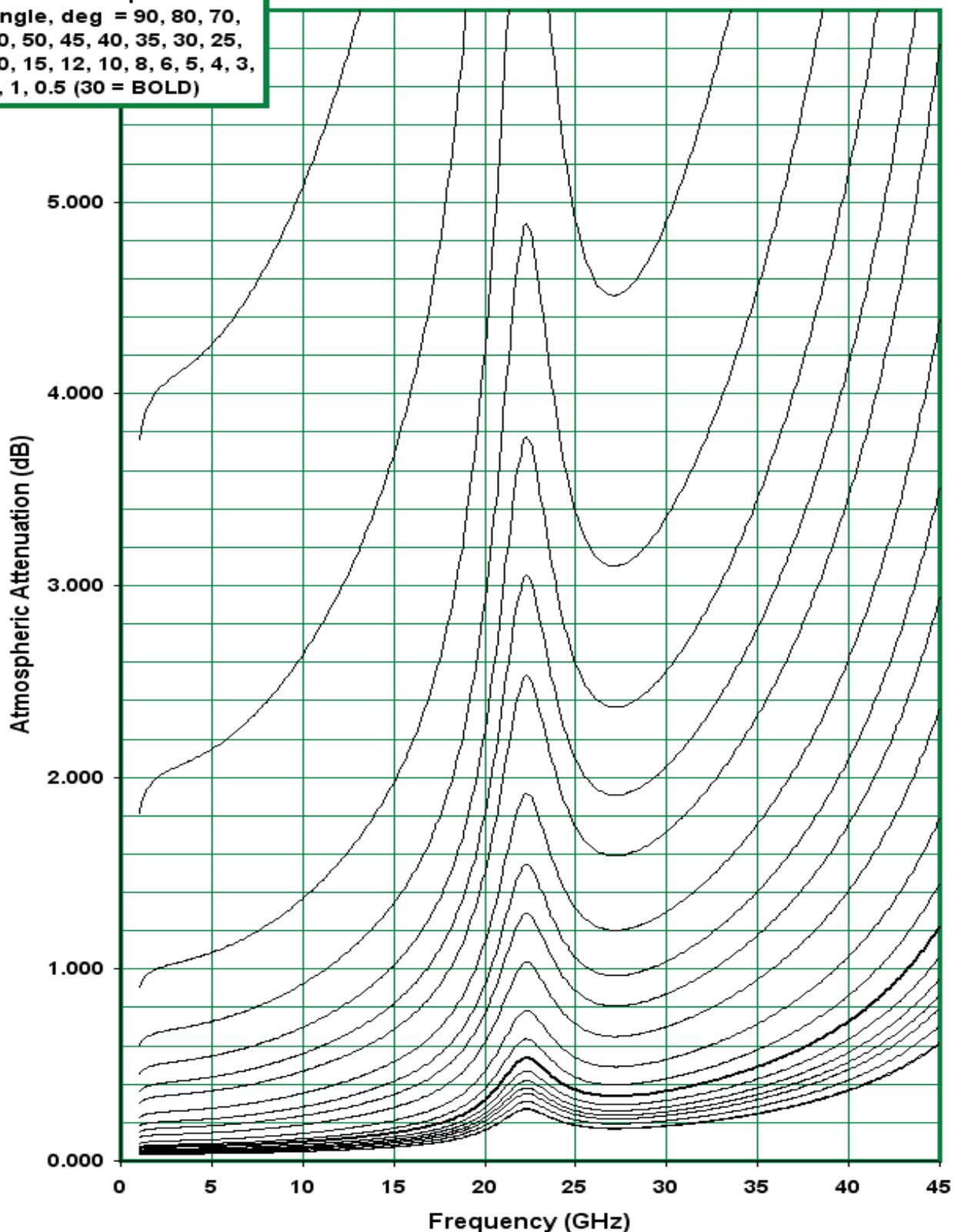
Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)



Atmospheric Attenuation as a Function of Frequency and Elevation Angle

Station = Madrid CD = 0.40

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)



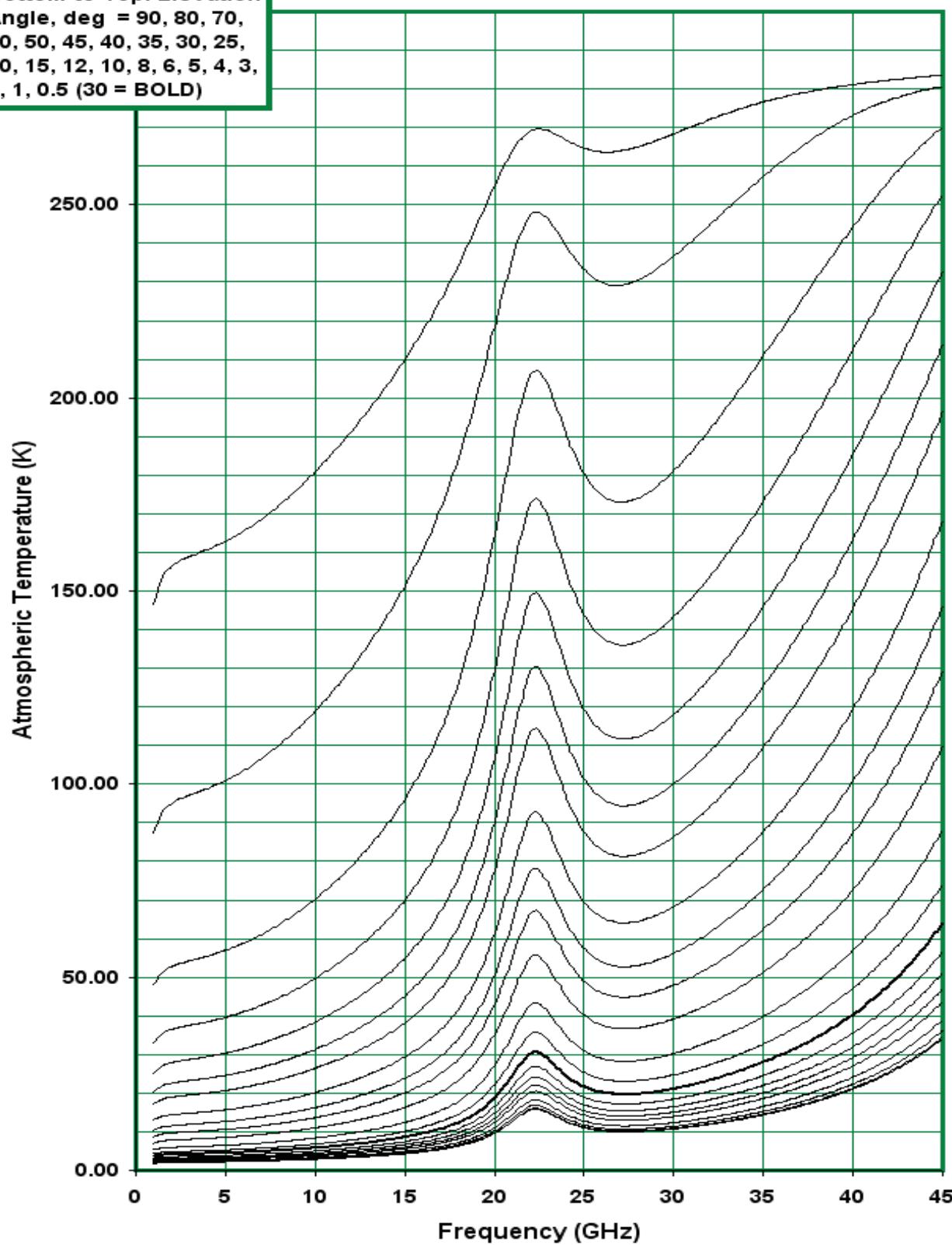
Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

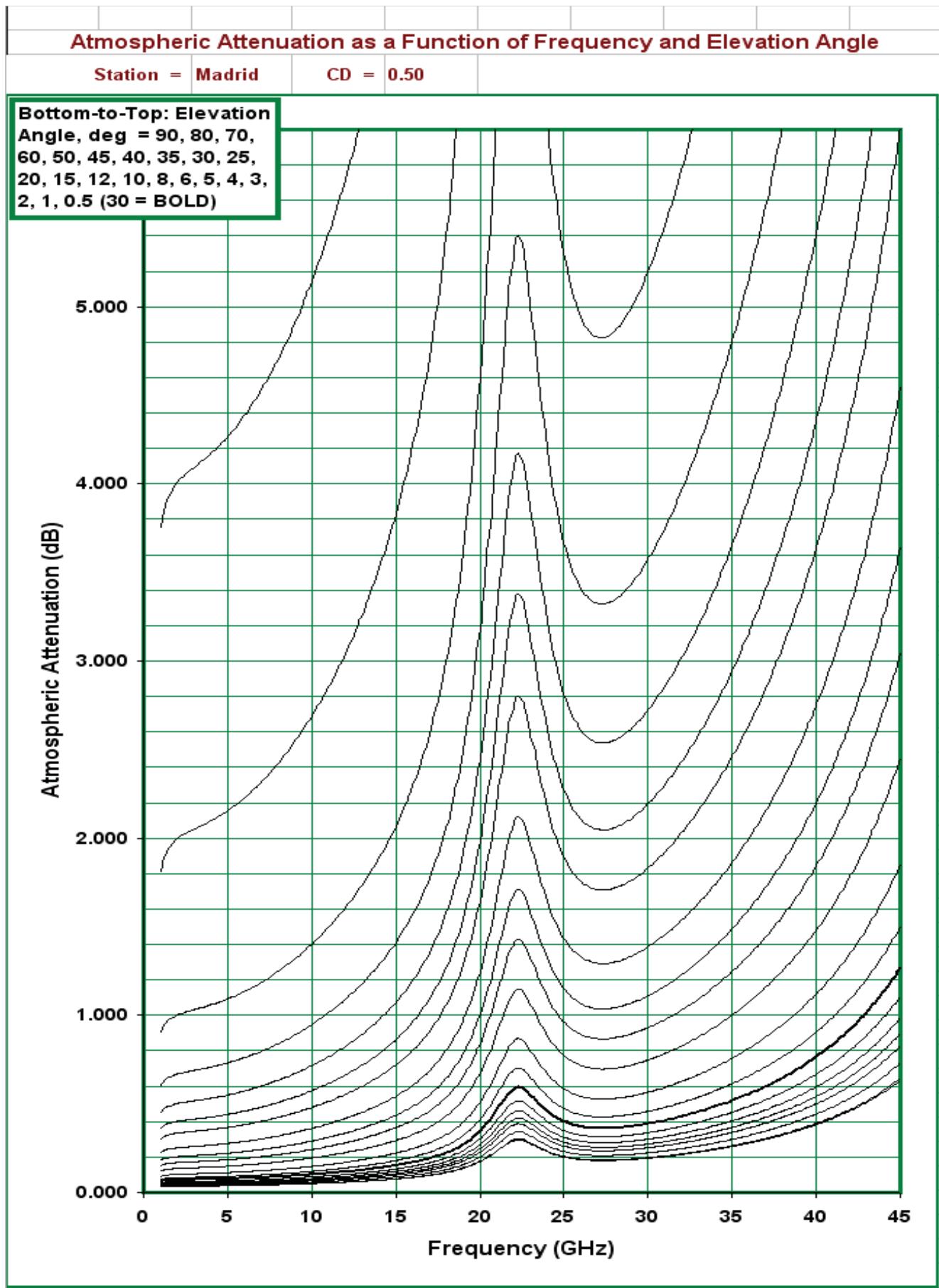
Station = Madrid

CD = 0.40

as a Function of Frequency and Elevation Angle

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)





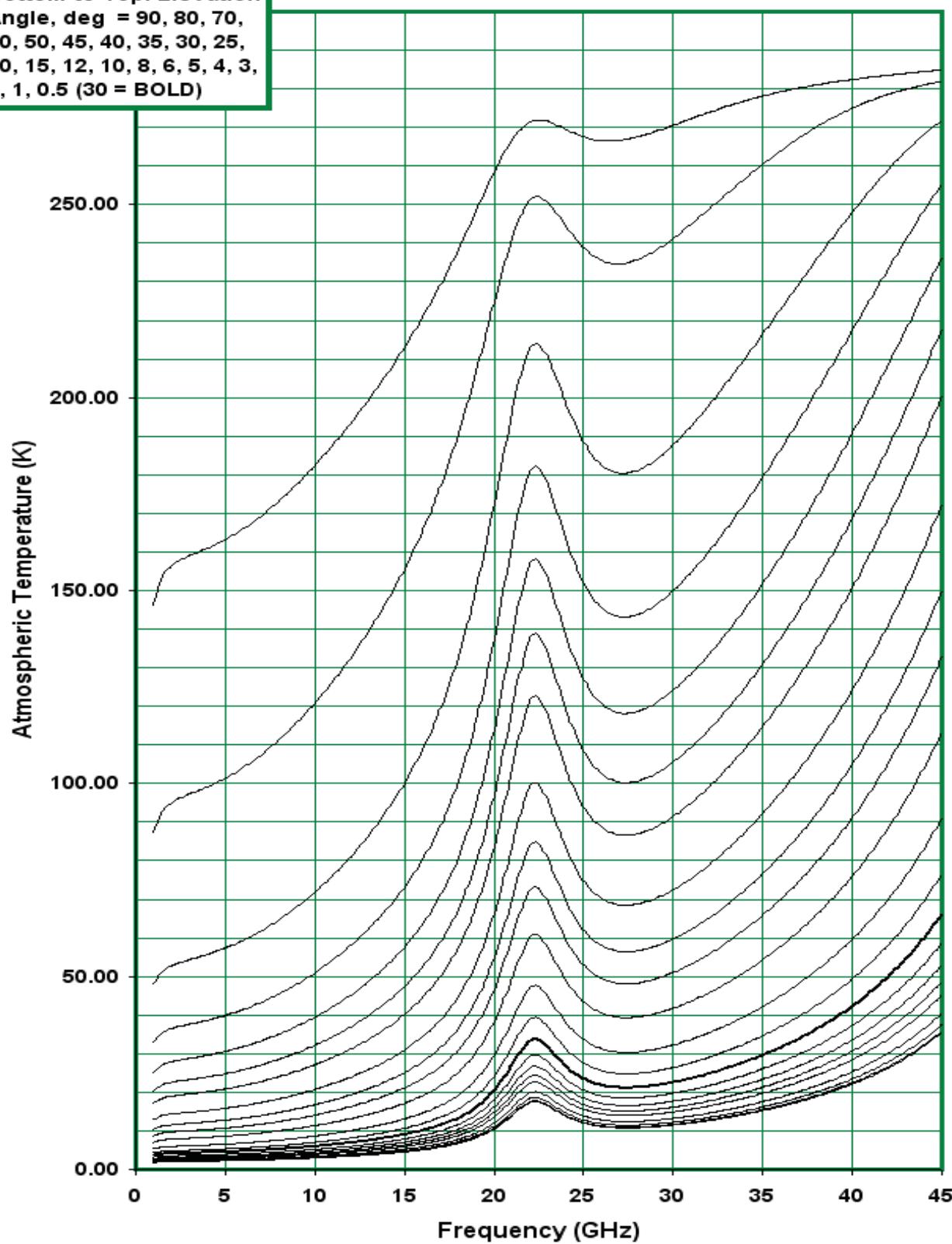
Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

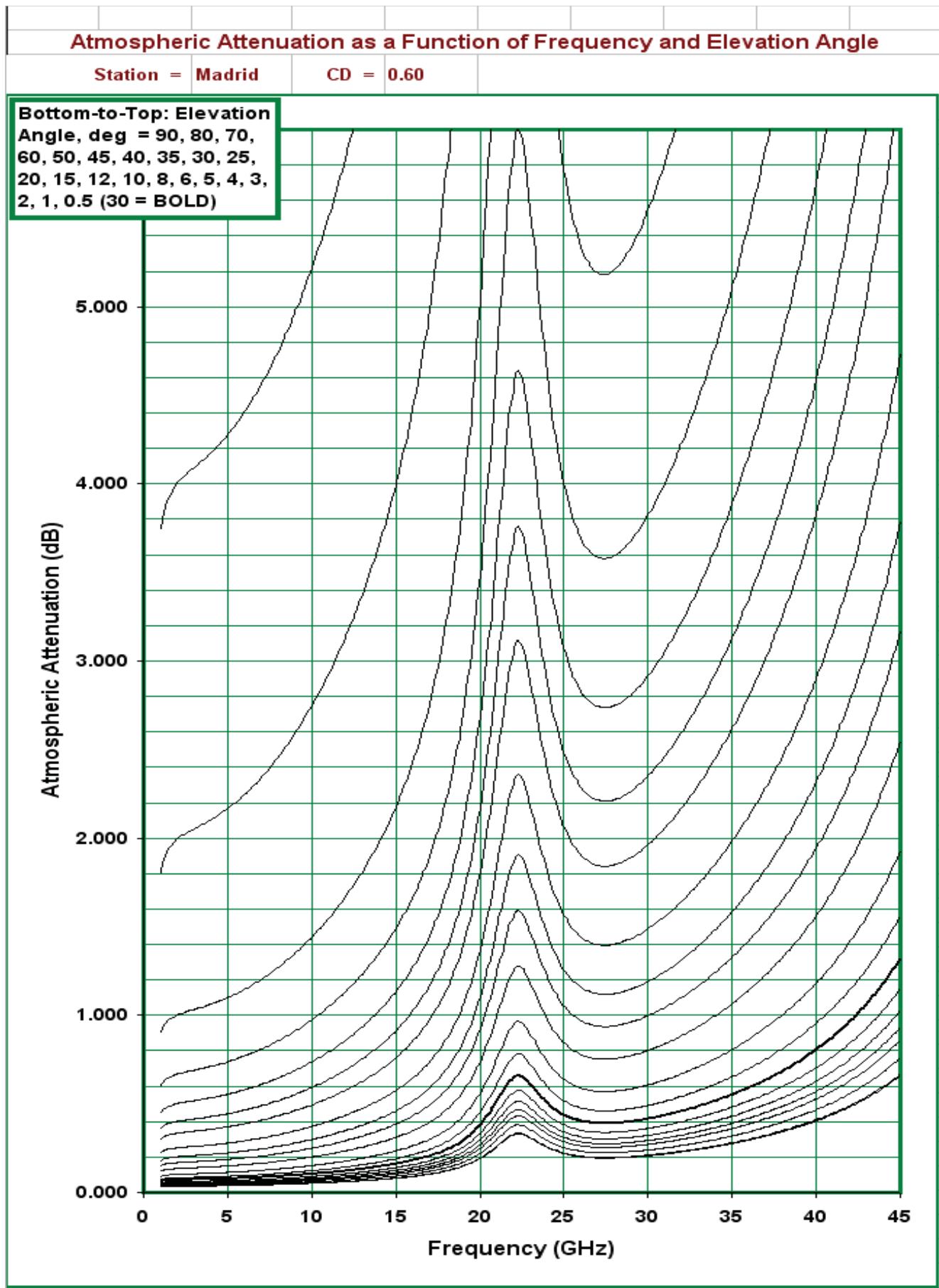
Station = Madrid

CD = 0.50

as a Function of Frequency and Elevation Angle

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)





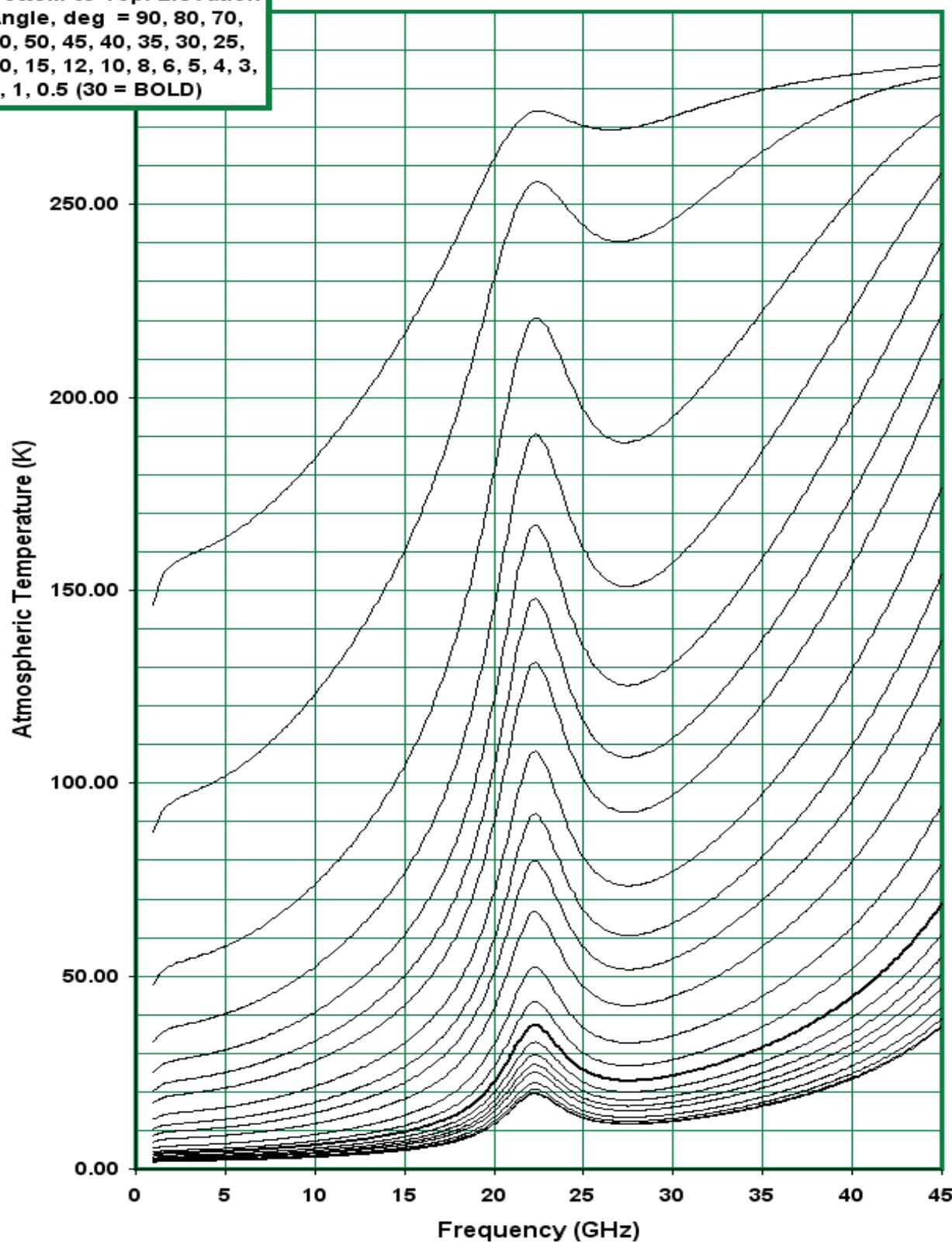
Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

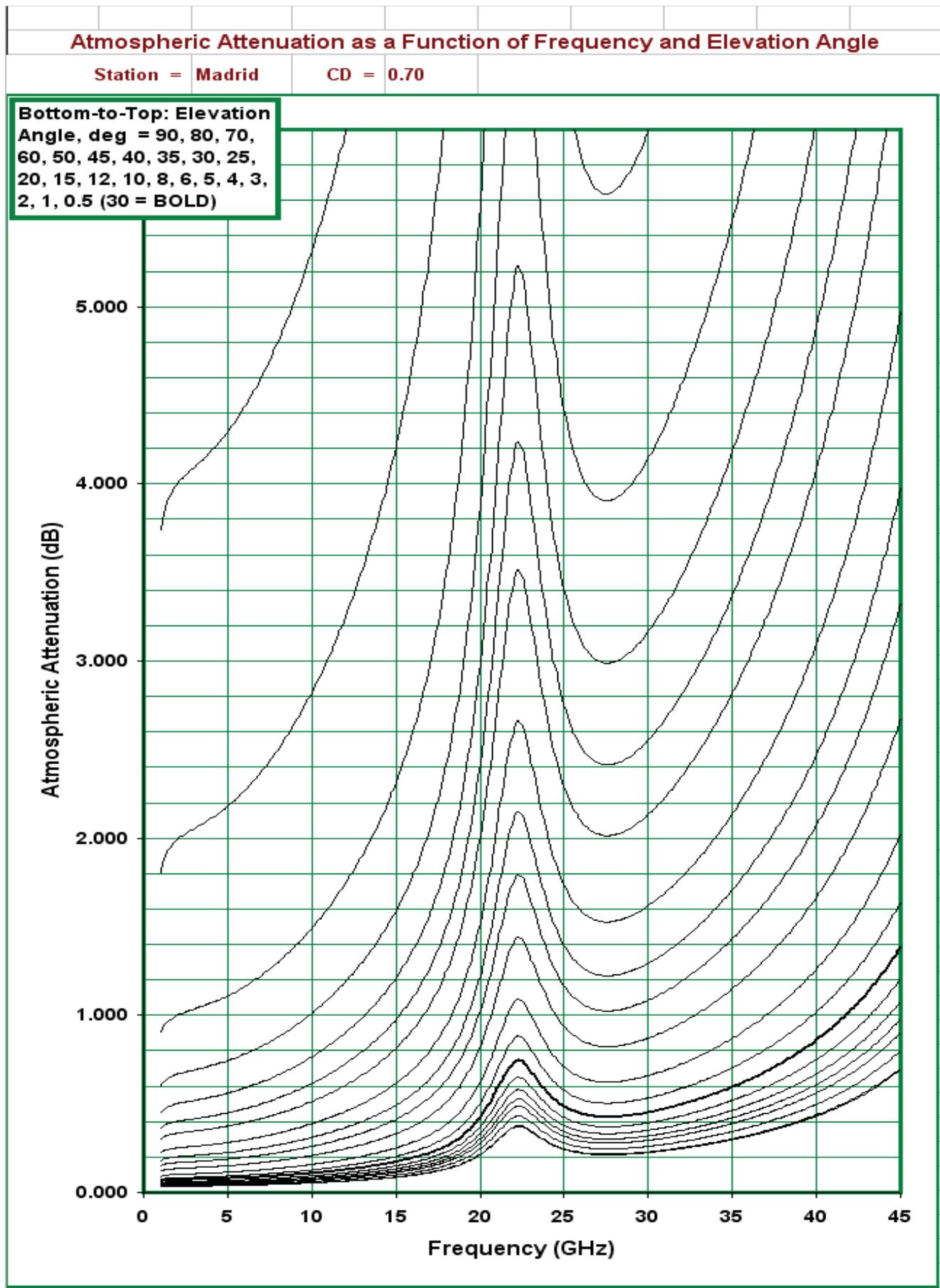
Station = Madrid

CD = 0.60

as a Function of Frequency and Elevation Angle

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)





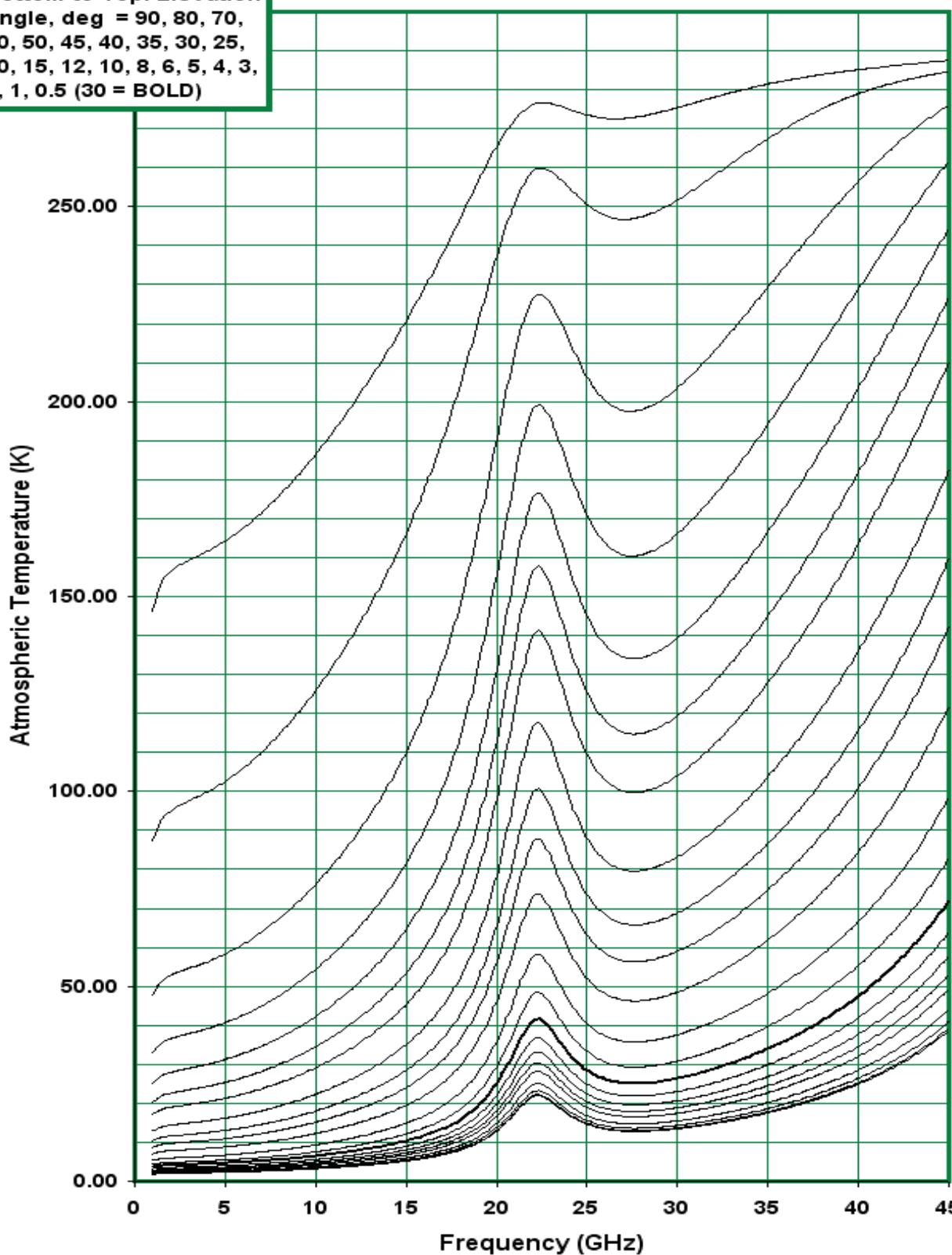
Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

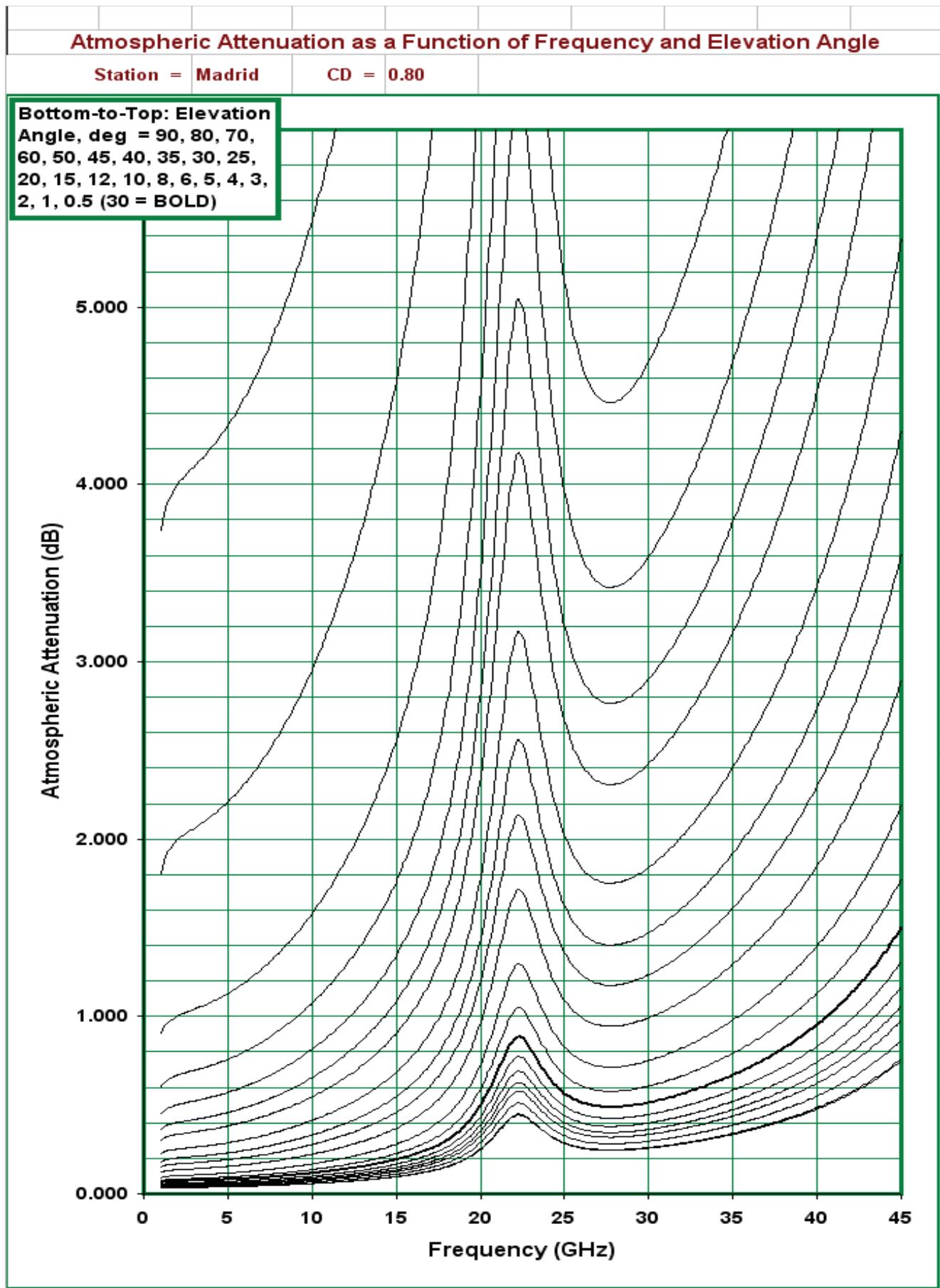
Station = Madrid

CD = 0.70

as a Function of Frequency and Elevation Angle

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)





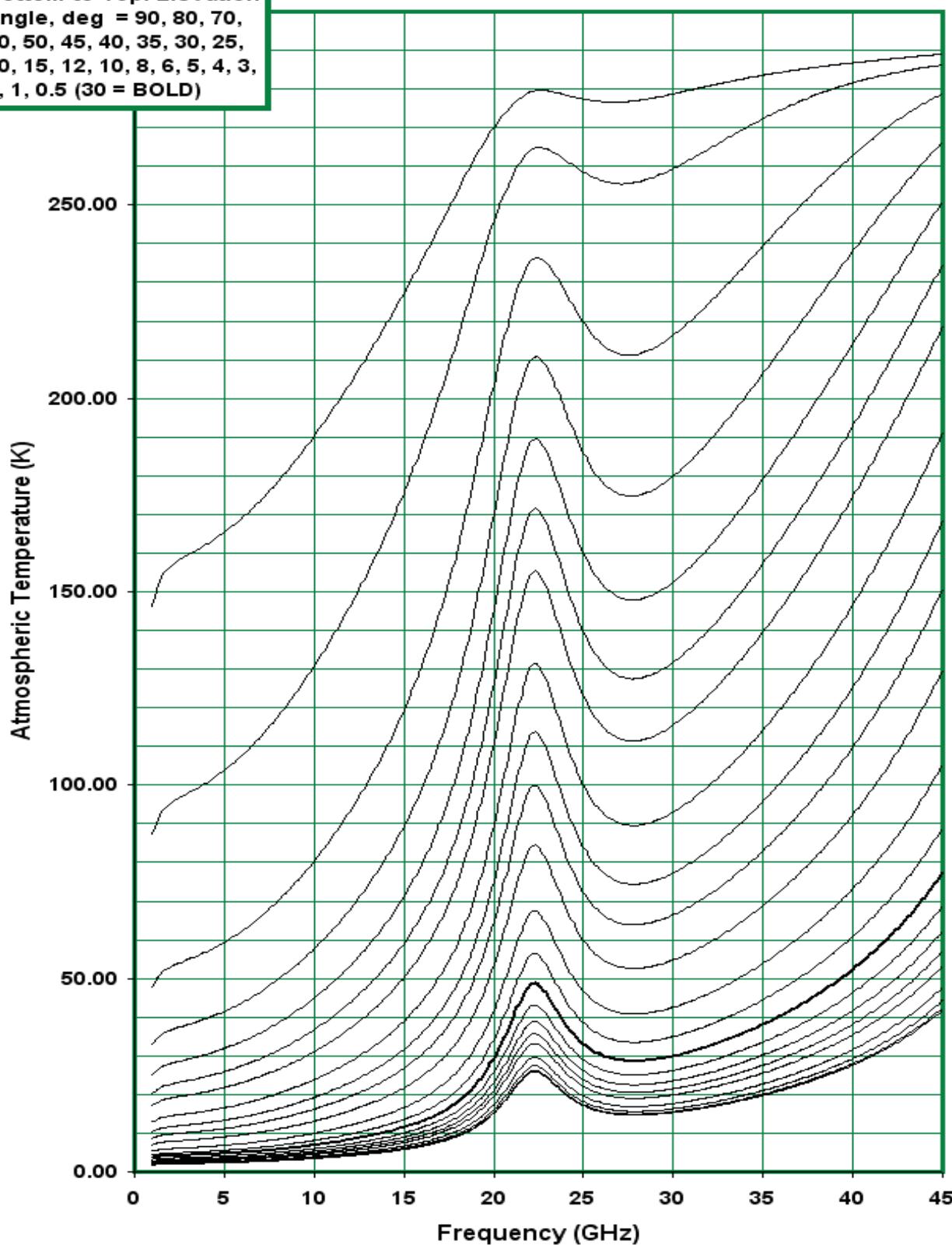
Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

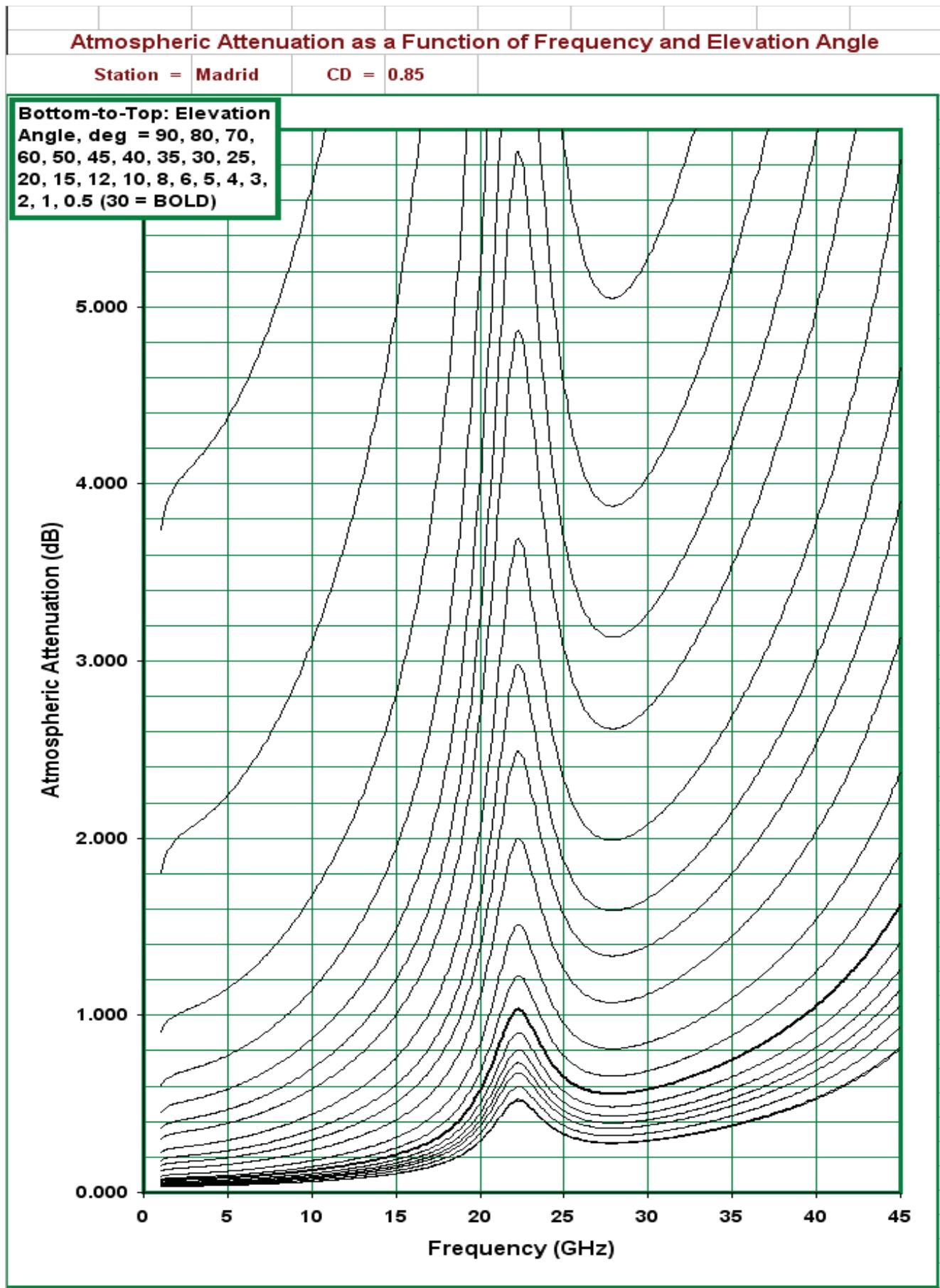
Station = Madrid

CD = 0.80

as a Function of Frequency and Elevation Angle

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)





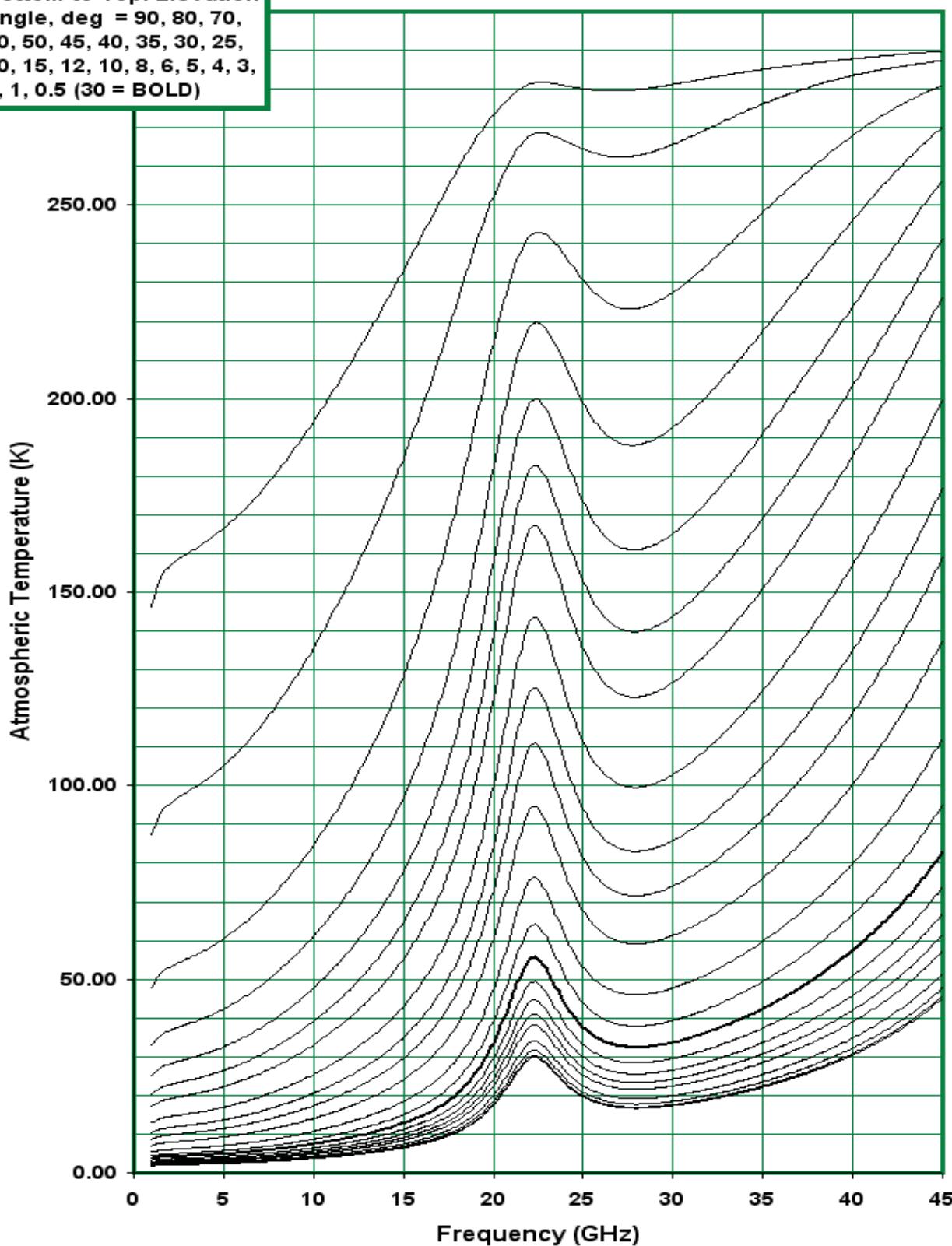
Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

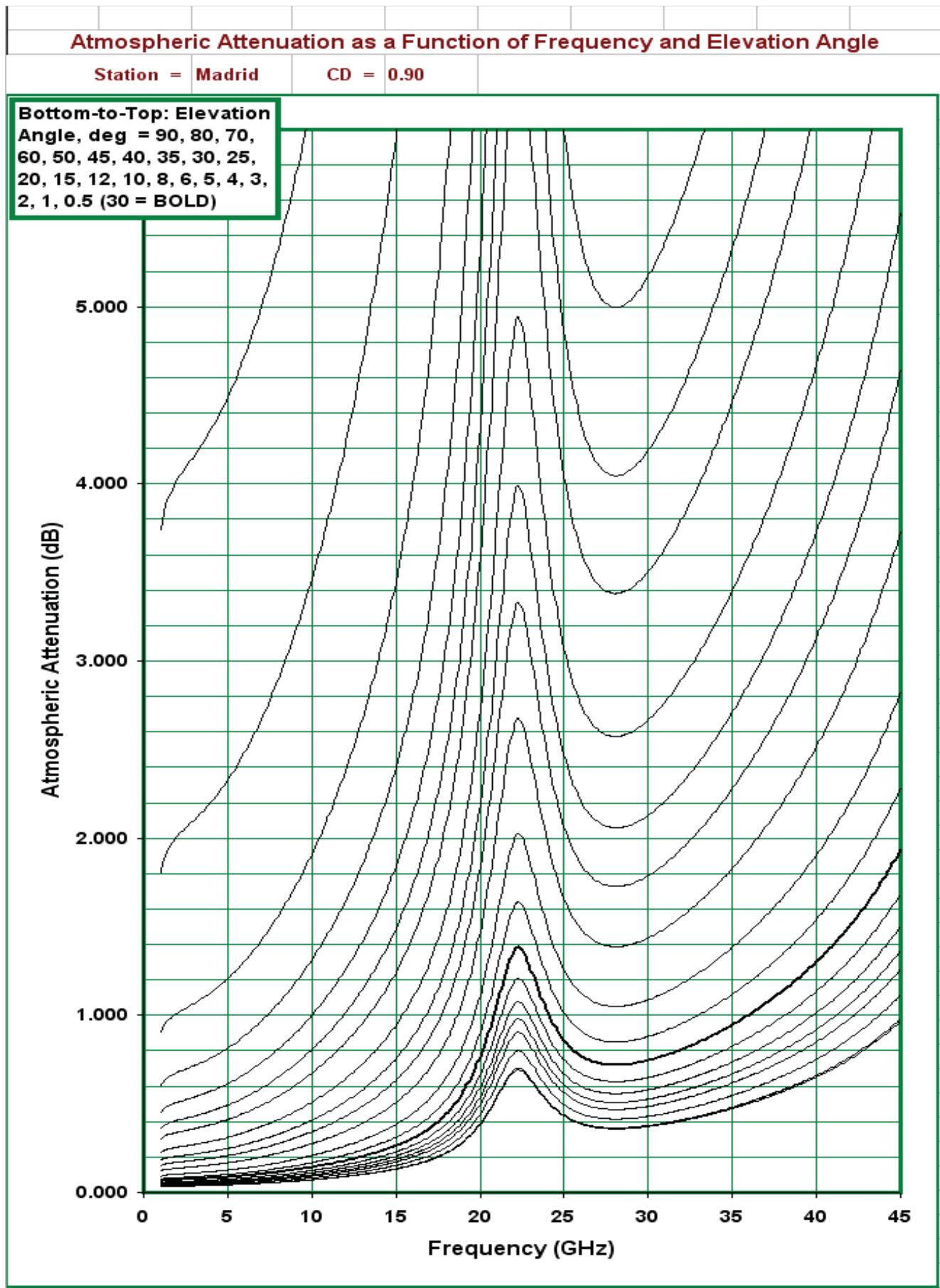
Station = Madrid

CD = 0.85

as a Function of Frequency and Elevation Angle

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)





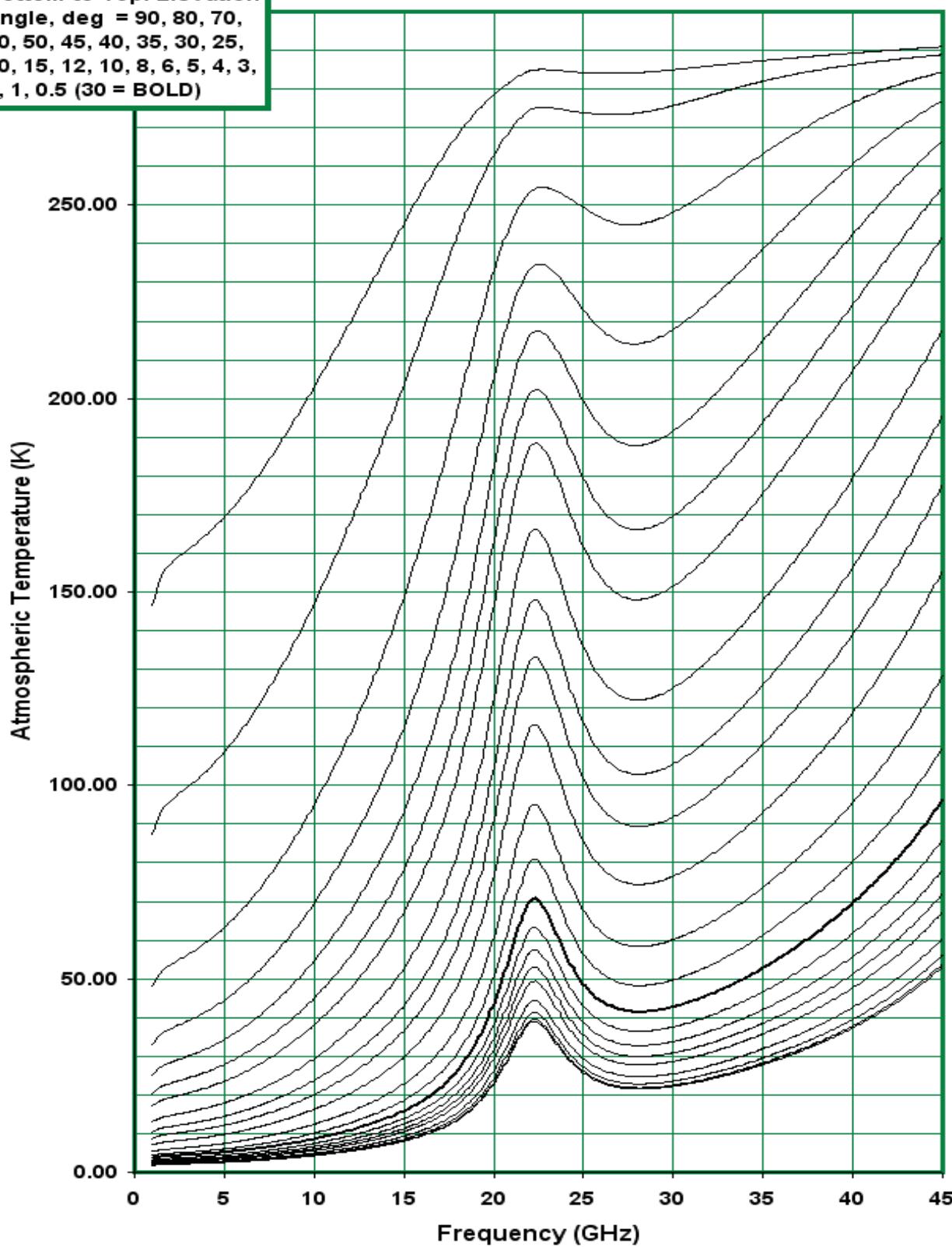
Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

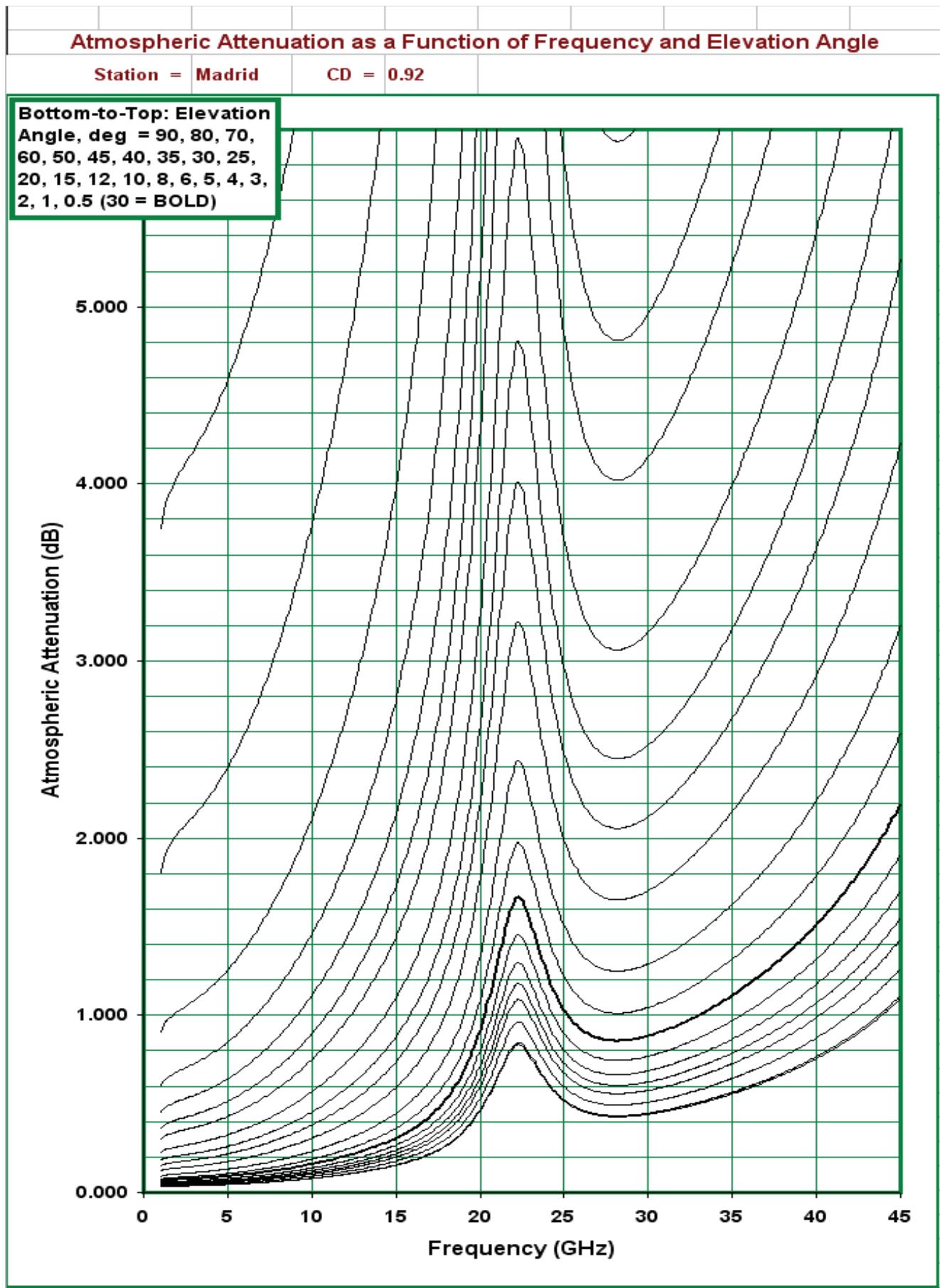
Station = Madrid

CD = 0.90

as a Function of Frequency and Elevation Angle

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)





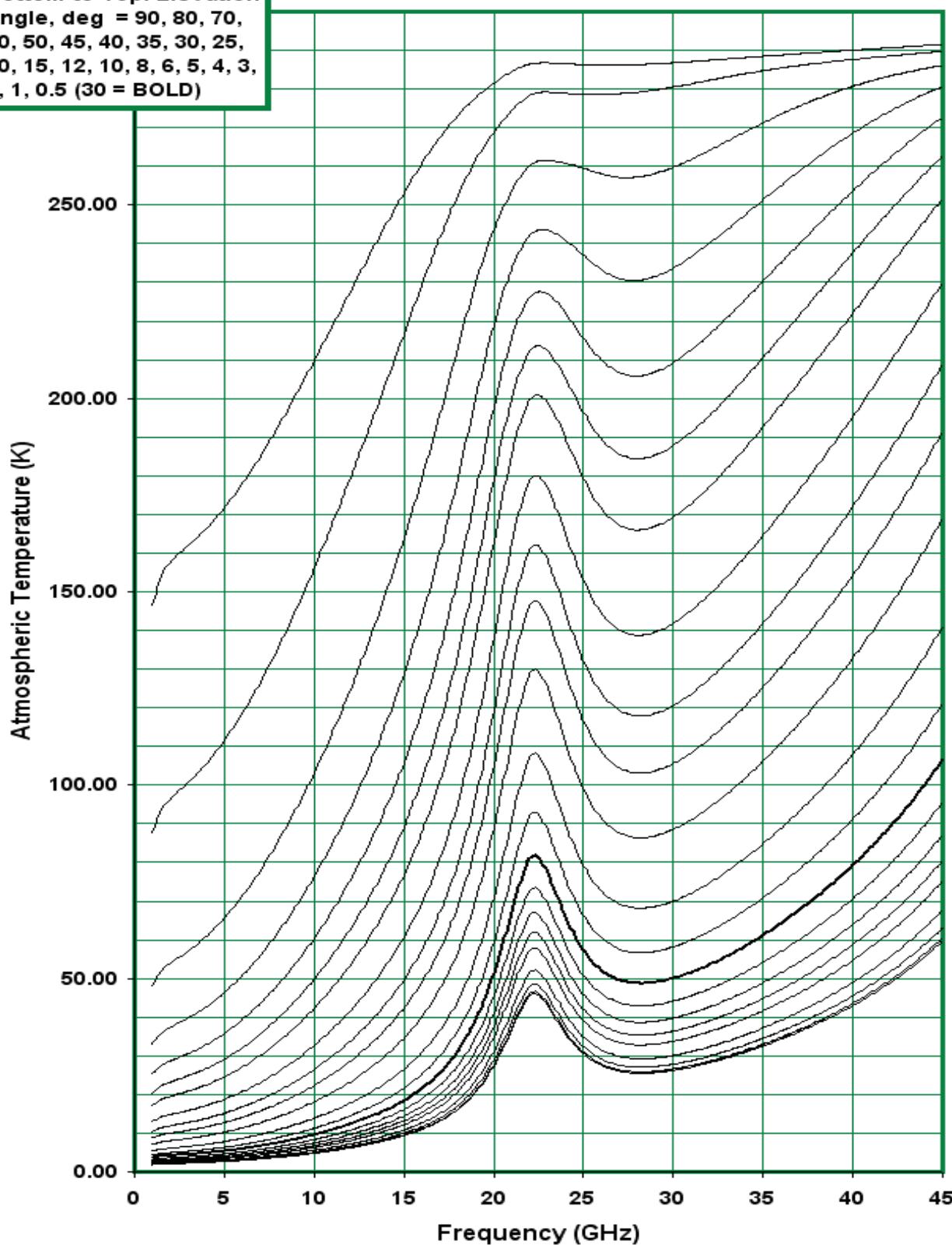
Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

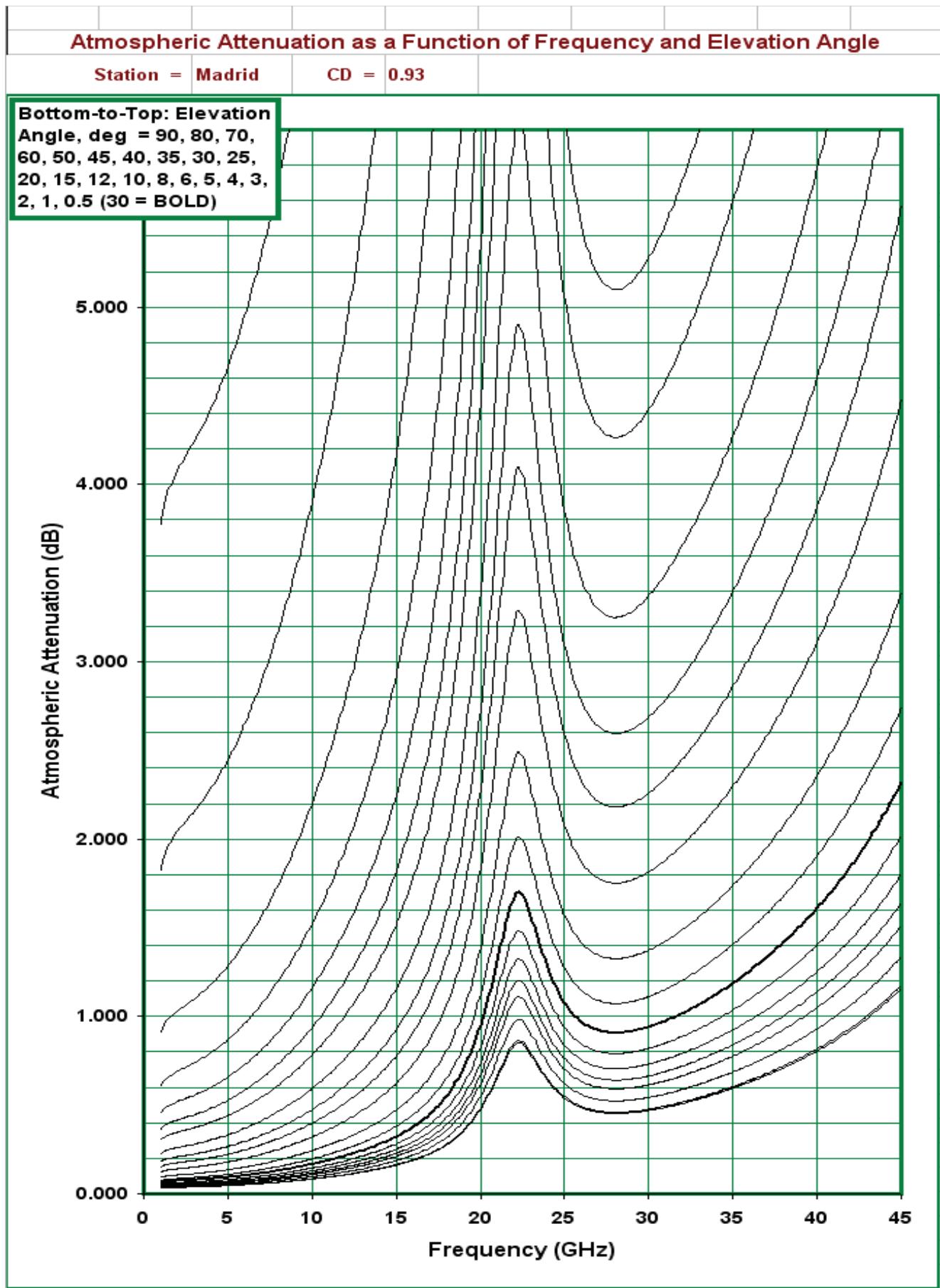
Station = Madrid

CD = 0.92

as a Function of Frequency and Elevation Angle

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)





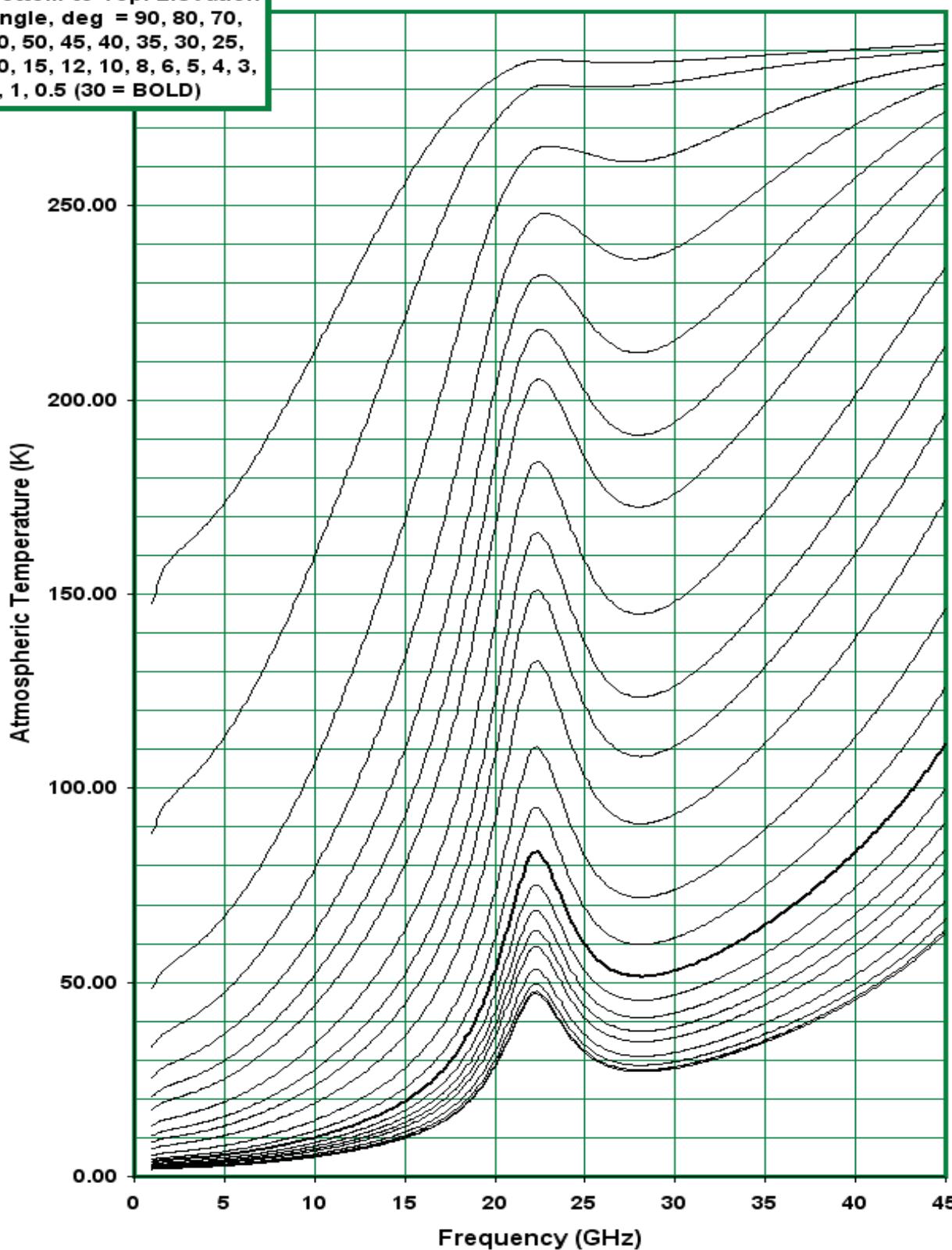
Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

Station = Madrid

CD = 0.93

as a Function of Frequency and Elevation Angle

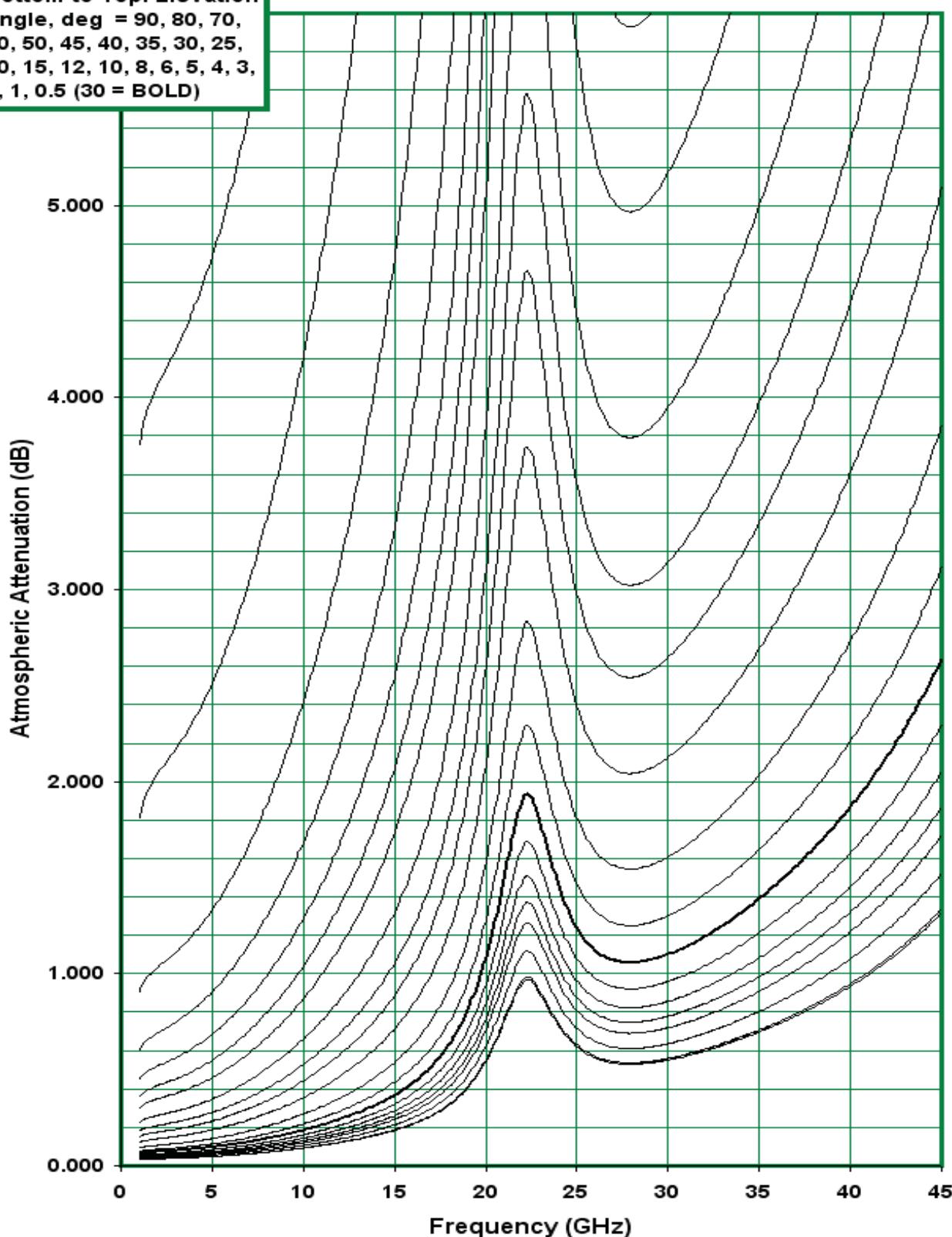
Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)



Atmospheric Attenuation as a Function of Frequency and Elevation Angle

Station = Madrid CD = 0.94

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)



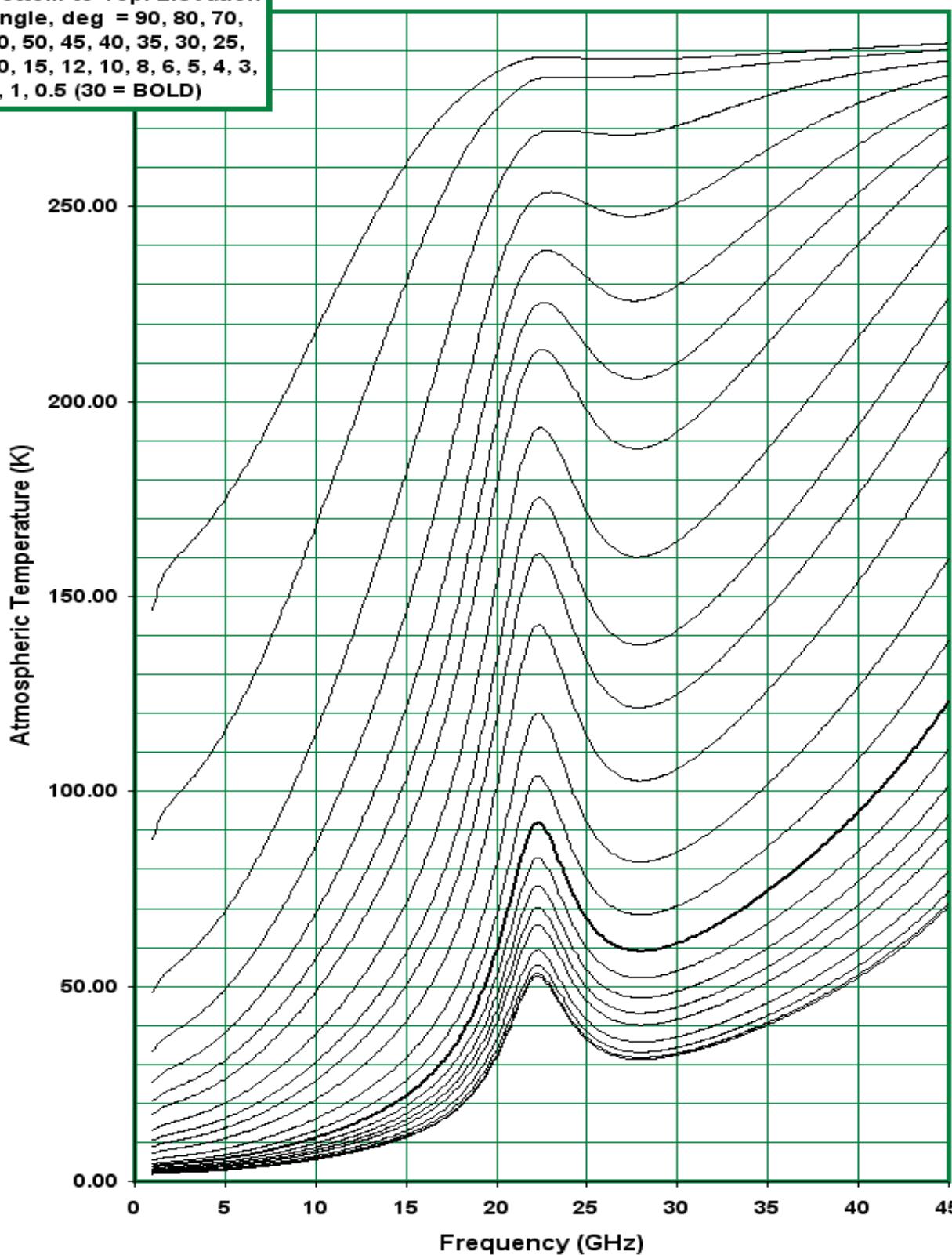
Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

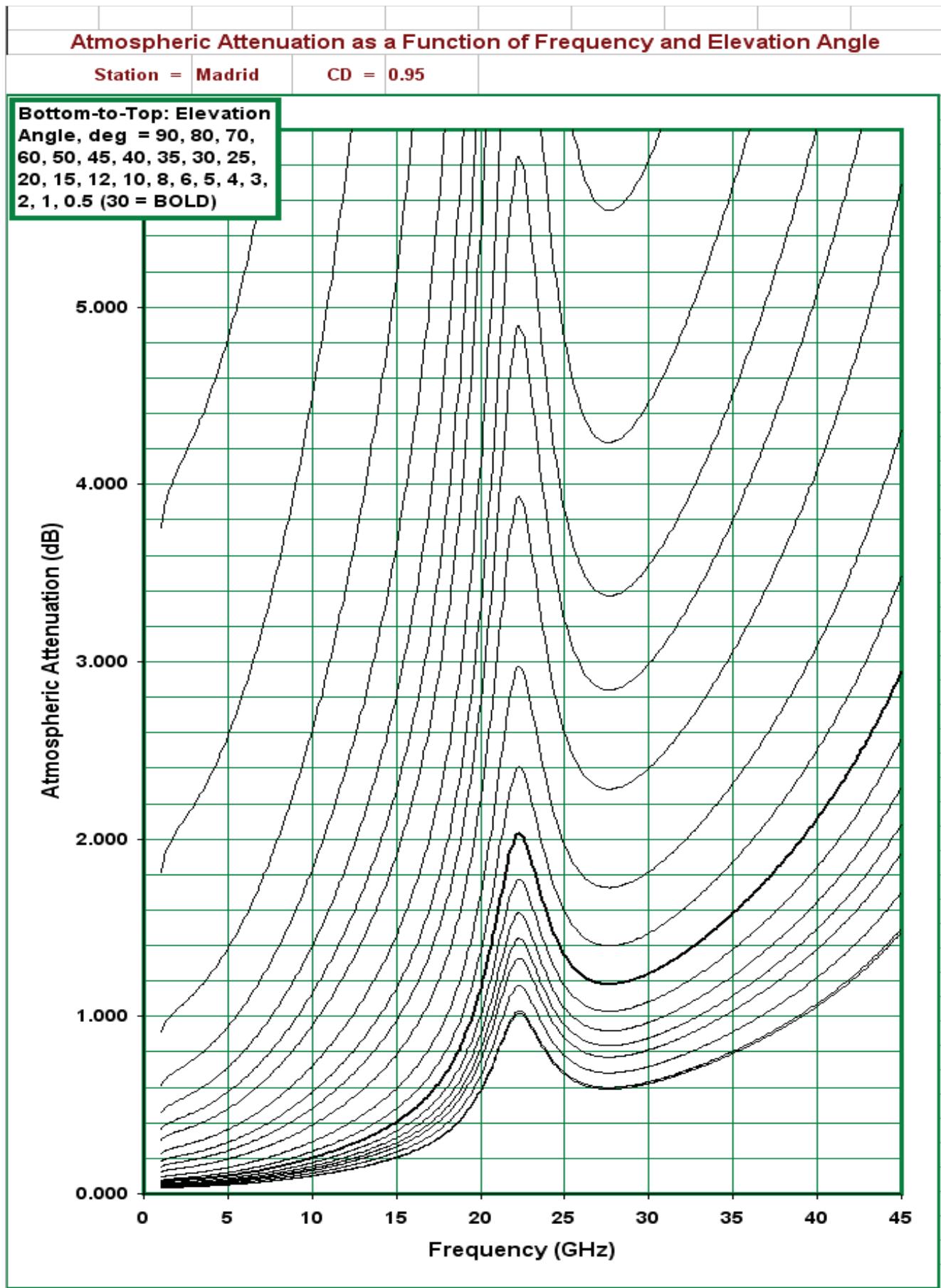
Station = Madrid

CD = 0.94

as a Function of Frequency and Elevation Angle

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)





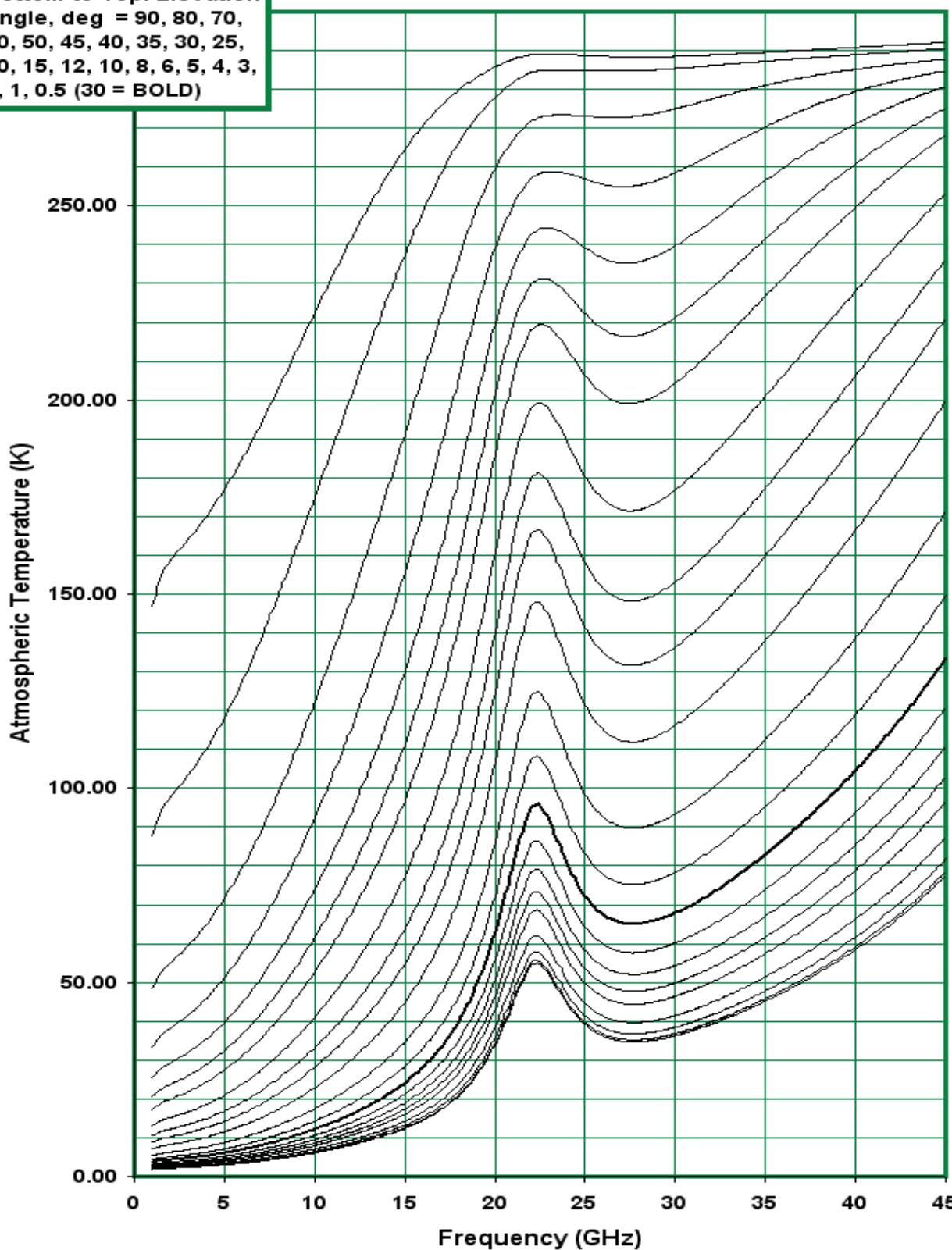
Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

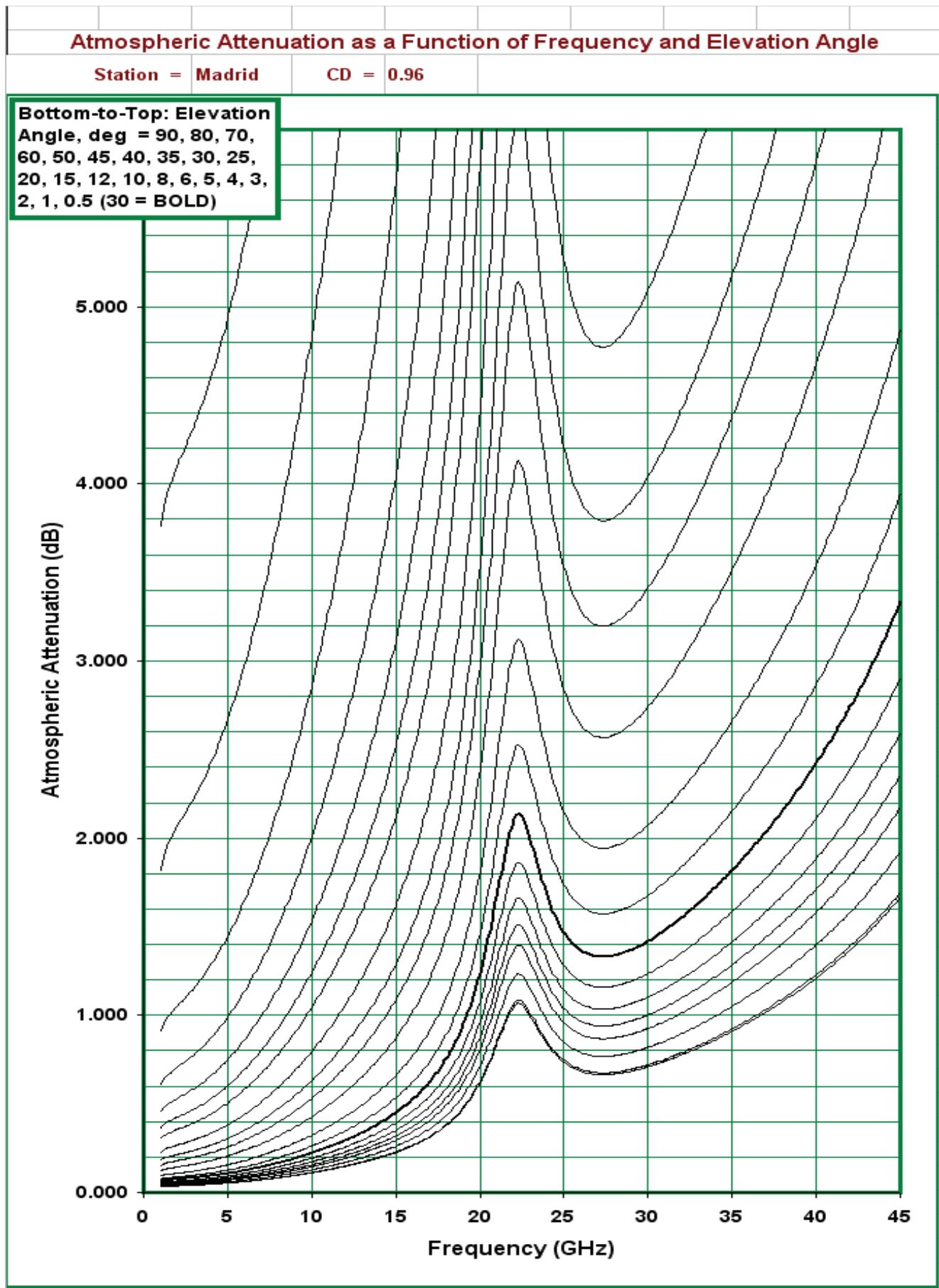
Station = Madrid

CD = 0.95

as a Function of Frequency and Elevation Angle

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)





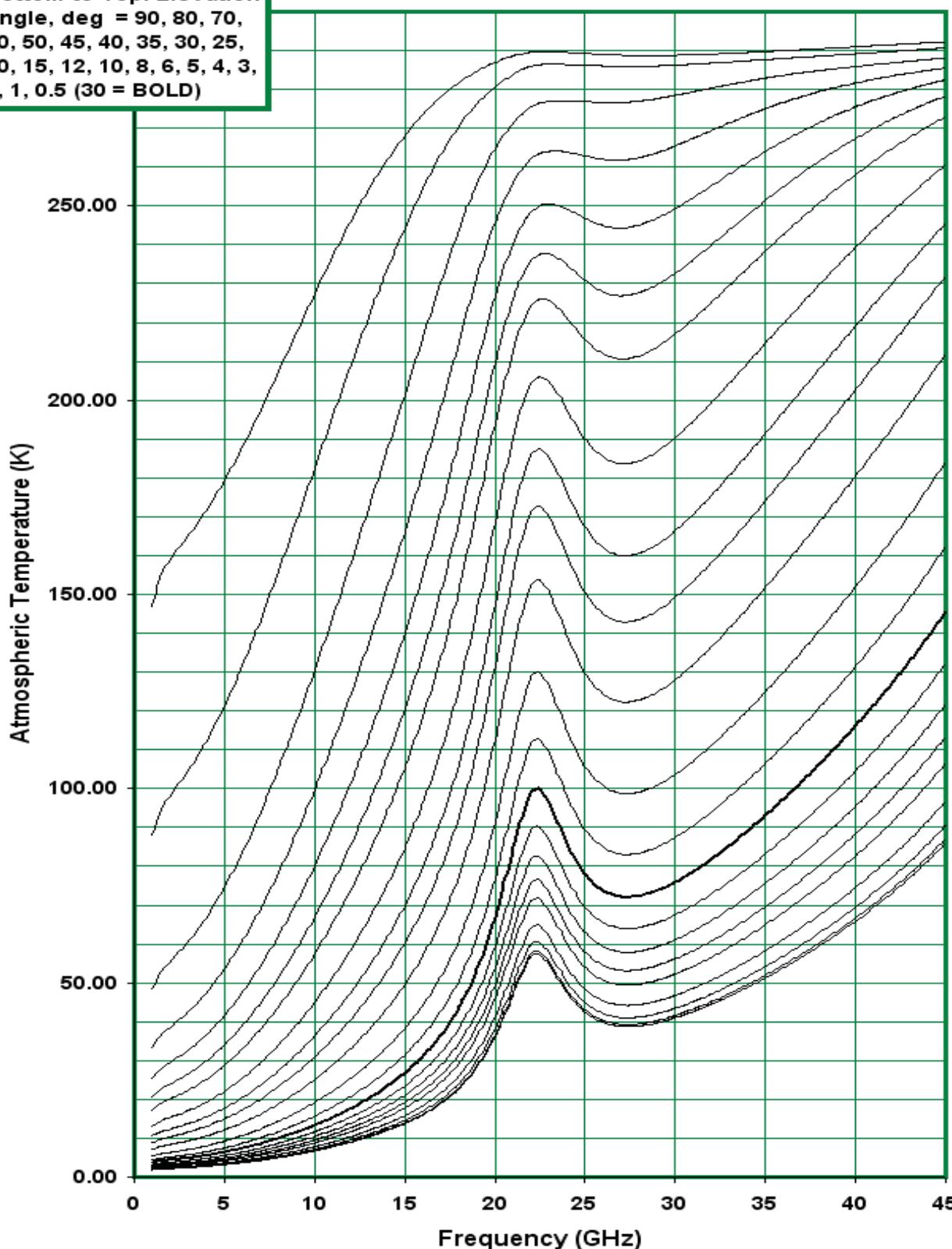
Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

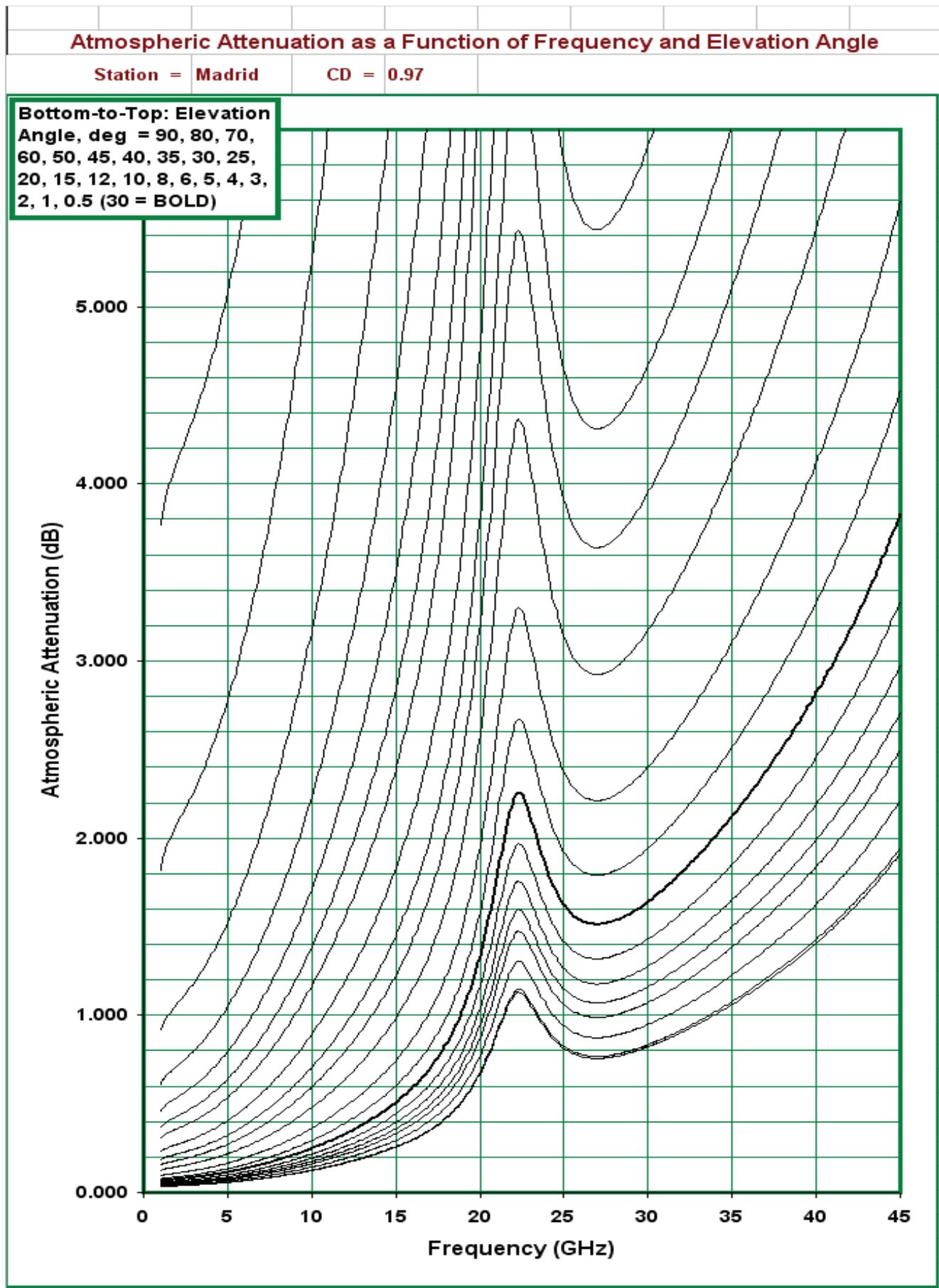
Station = Madrid

CD = 0.96

as a Function of Frequency and Elevation Angle

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)





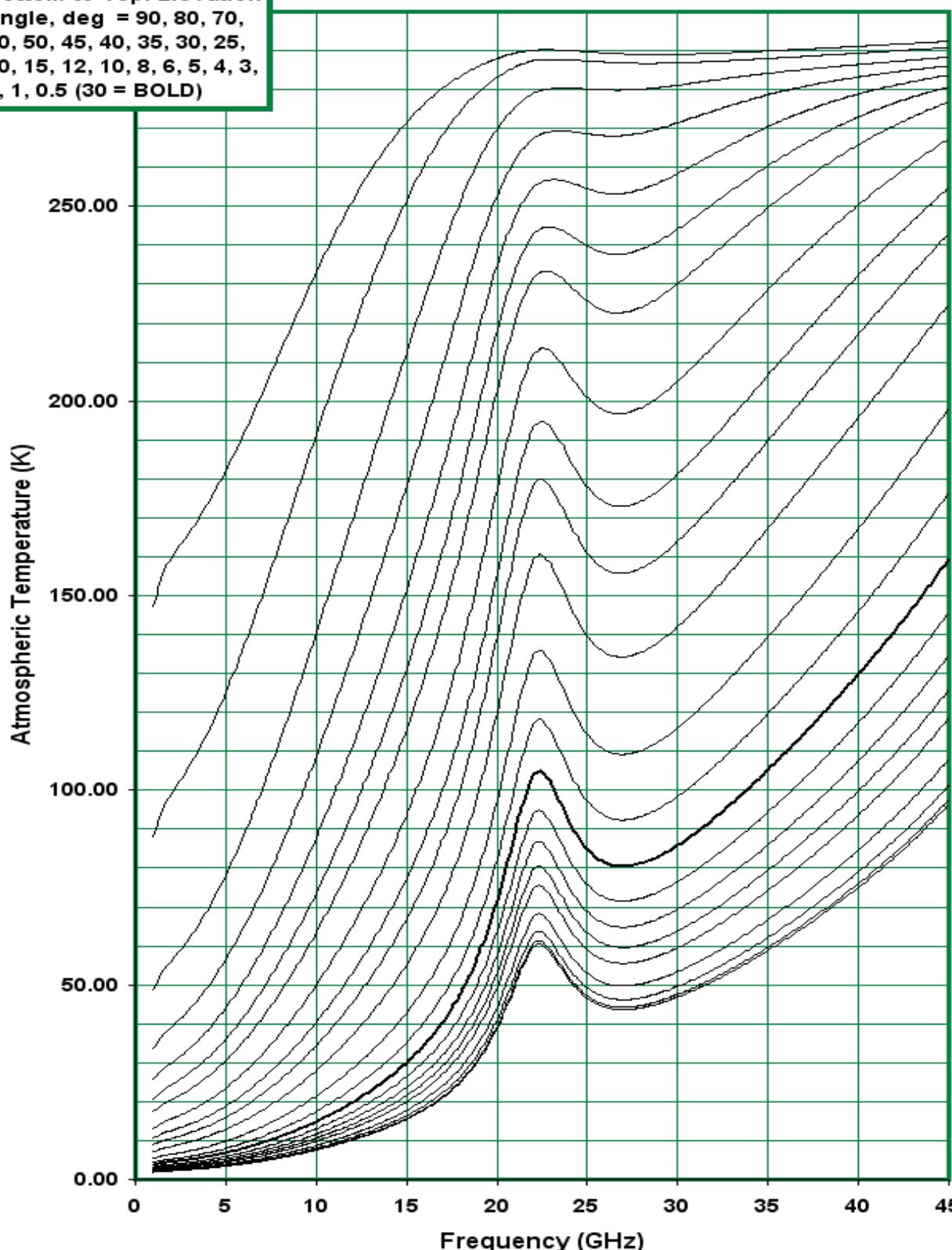
Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

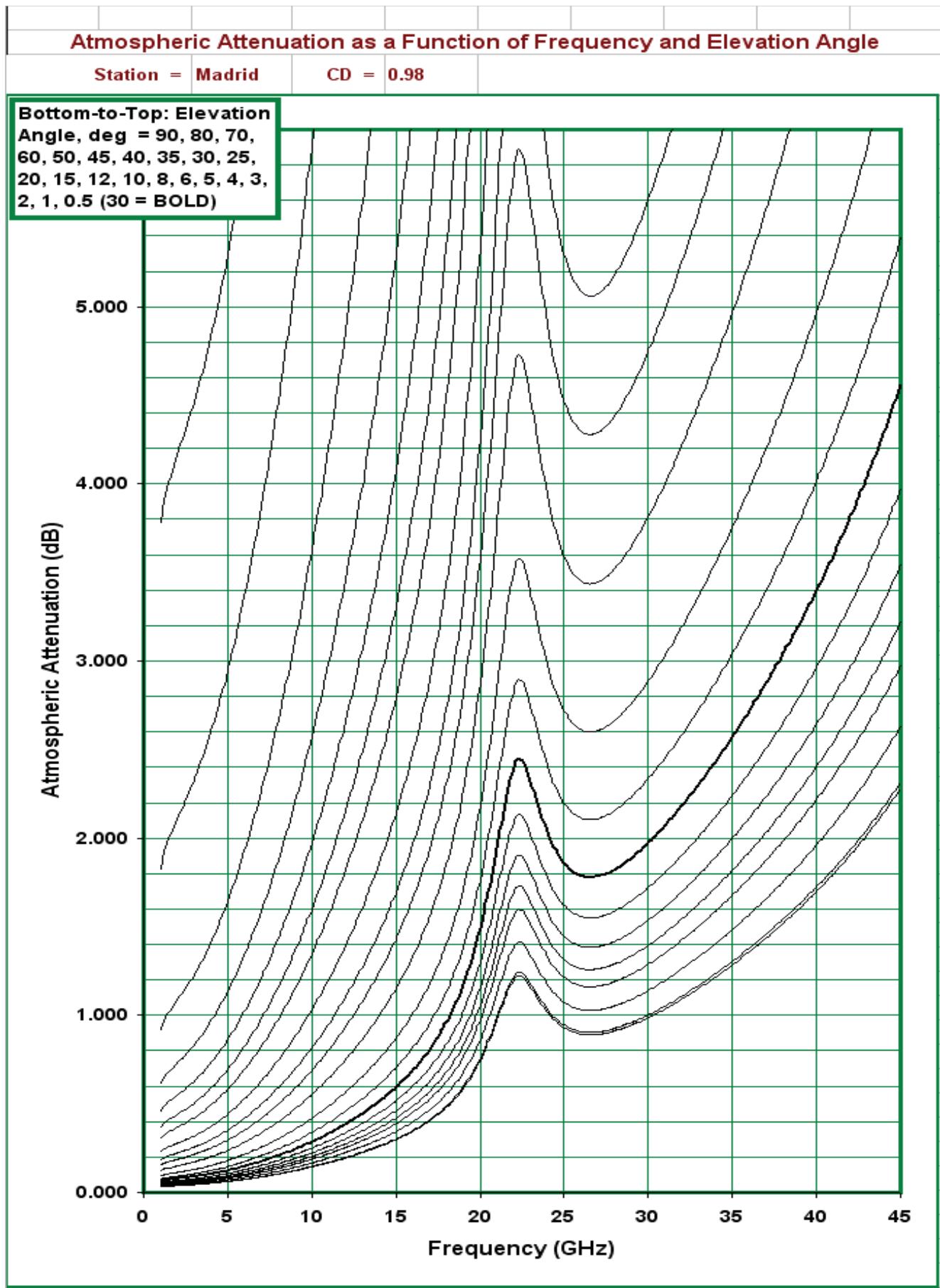
Station = Madrid

CD = 0.97

as a Function of Frequency and Elevation Angle

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)





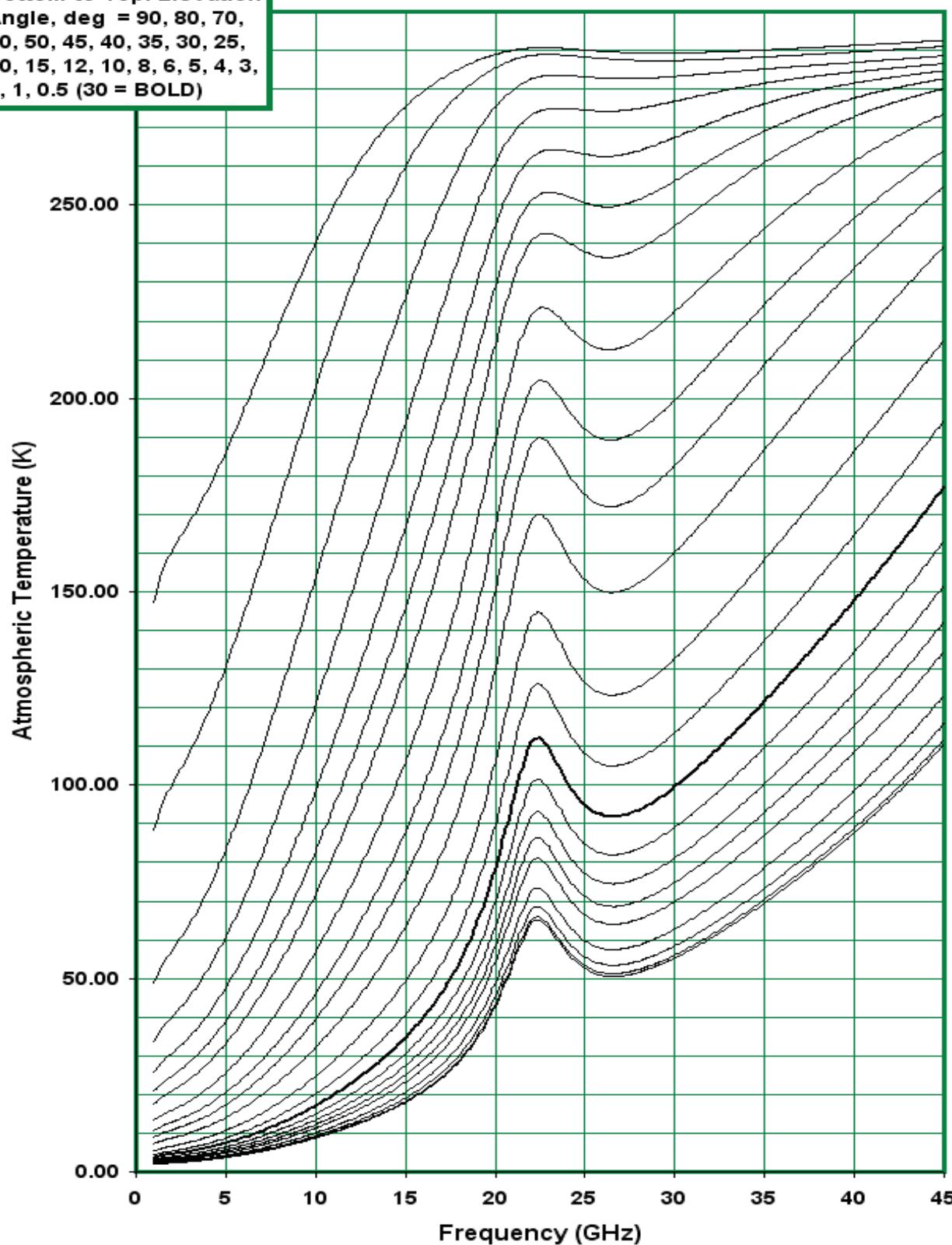
Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

Station = Madrid

CD = 0.98

as a Function of Frequency and Elevation Angle

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)

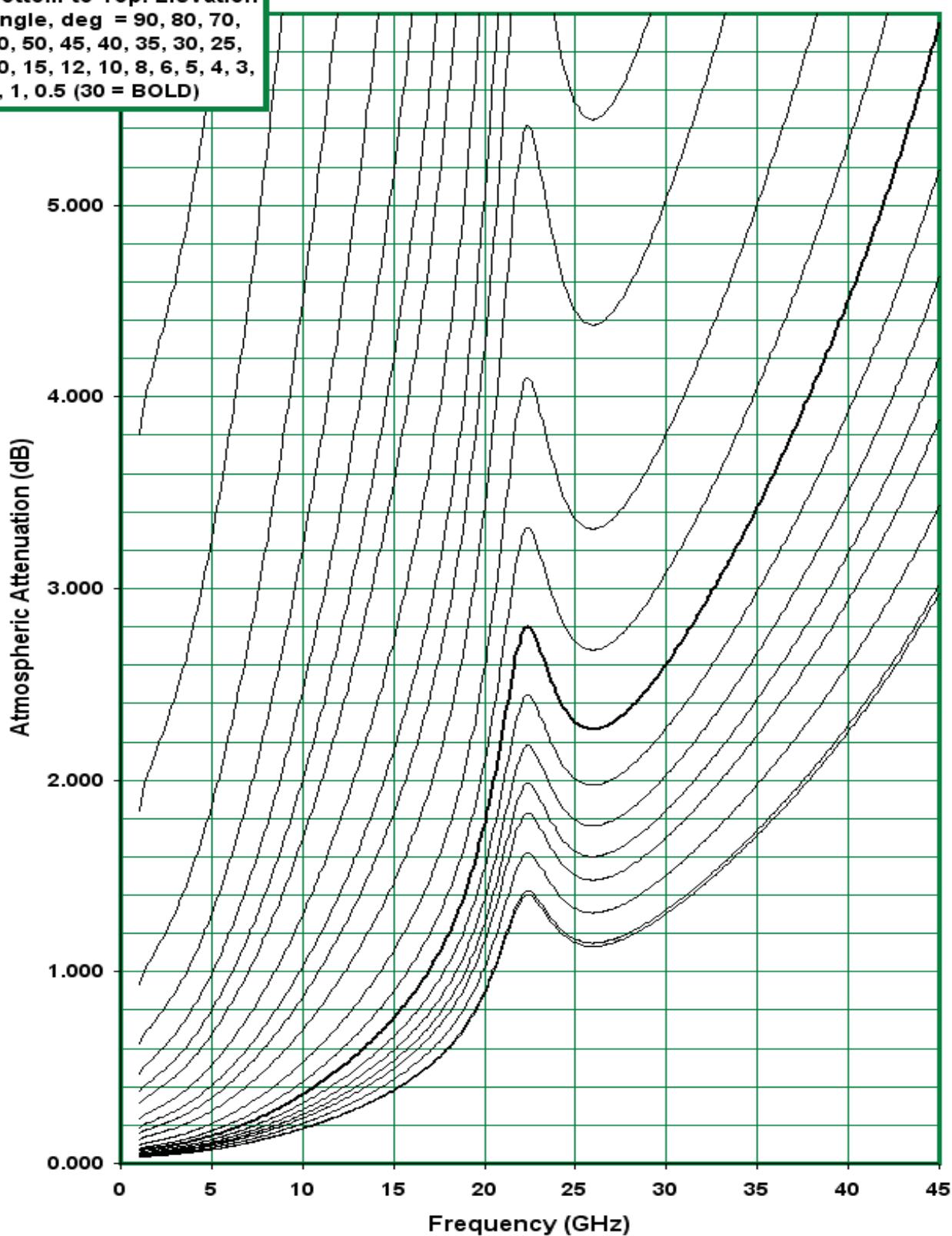


Atmospheric Attenuation as a Function of Frequency and Elevation Angle

Station = Madrid

CD = 0.99

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)



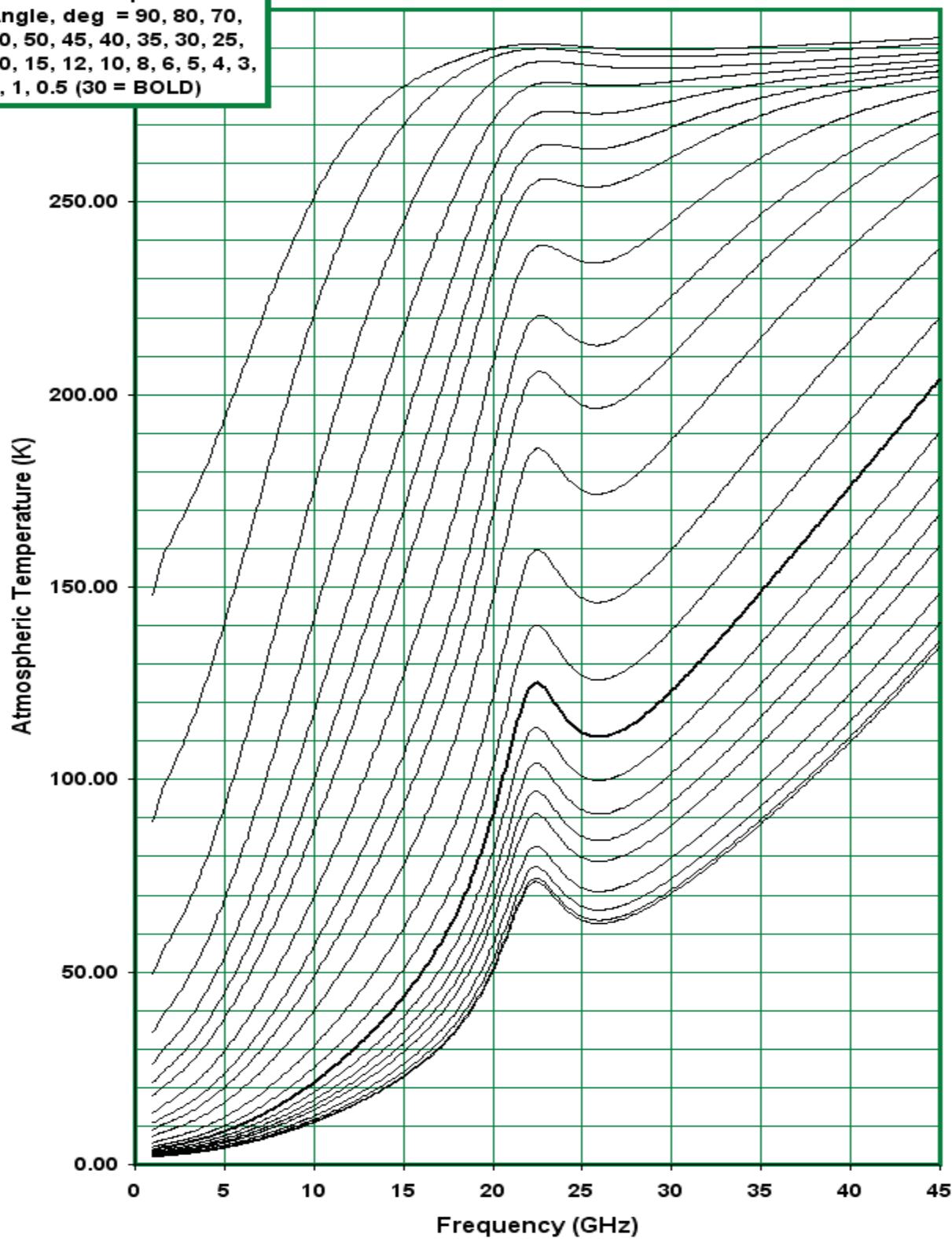
Atmospheric Noise Temperature as a Function of Frequency and Elevation Angle

Station = Madrid

CD = 0.99

as a Function of Frequency and Elevation Angle

Bottom-to-Top: Elevation Angle, deg = 90, 80, 70, 60, 50, 45, 40, 35, 30, 25, 20, 15, 12, 10, 8, 6, 5, 4, 3, 2, 1, 0.5 (30 = BOLD)



Appendix 3 –

Tables of Atmosphere Attenuation and Noise Temperature as a Function of Frequency and Elevation Angle

DSN Stations
S-Band (2.250 GHz)

Goldstone Stations
S-Band (2.250 GHz)

Goldstone Stations S-Band (Frequency = 2.250 GHz)			
CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.00	0.5	3.861	152.009
0.00	1.0	1.931	91.727
0.00	2.0	0.966	50.688
0.00	3.0	0.644	34.976
0.00	4.0	0.483	26.698
0.00	5.0	0.387	21.591
0.00	6.0	0.322	18.128
0.00	8.0	0.242	13.735
0.00	10.0	0.194	11.065
0.00	12.0	0.162	9.274
0.00	15.0	0.130	7.476
0.00	20.0	0.099	5.677
0.00	25.0	0.080	4.604
0.00	30.0	0.067	3.896
0.00	35.0	0.059	3.400
0.00	40.0	0.052	3.036
0.00	45.0	0.048	2.761
0.00	50.0	0.044	2.550
0.00	60.0	0.039	2.257
0.00	70.0	0.036	2.080
0.00	80.0	0.034	1.985
0.00	90.0	0.034	1.955
0.10	0.5	3.858	152.120
0.10	1.0	1.931	91.837
0.10	2.0	0.966	50.777
0.10	3.0	0.644	35.044
0.10	4.0	0.484	26.753
0.10	5.0	0.387	21.637
0.10	6.0	0.323	18.167
0.10	8.0	0.242	13.764
0.10	10.0	0.194	11.090
0.10	12.0	0.162	9.295
0.10	15.0	0.130	7.492
0.10	20.0	0.099	5.689
0.10	25.0	0.080	4.614
0.10	30.0	0.067	3.905
0.10	35.0	0.059	3.407
0.10	40.0	0.052	3.043
0.10	45.0	0.048	2.767
0.10	50.0	0.044	2.555
0.10	60.0	0.039	2.262
0.10	70.0	0.036	2.085
0.10	80.0	0.034	1.990
0.10	90.0	0.034	1.960

Goldstone Stations S-Band (Frequency = 2.250 GHz)			
CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.20	0.5	3.852	152.120
0.20	1.0	1.928	91.827
0.20	2.0	0.965	50.777
0.20	3.0	0.644	35.046
0.20	4.0	0.483	26.755
0.20	5.0	0.387	21.639
0.20	6.0	0.322	18.169
0.20	8.0	0.242	13.766
0.20	10.0	0.194	11.091
0.20	12.0	0.162	9.296
0.20	15.0	0.130	7.493
0.20	20.0	0.099	5.690
0.20	25.0	0.080	4.614
0.20	30.0	0.067	3.905
0.20	35.0	0.059	3.408
0.20	40.0	0.052	3.043
0.20	45.0	0.048	2.768
0.20	50.0	0.044	2.556
0.20	60.0	0.039	2.262
0.20	70.0	0.036	2.085
0.20	80.0	0.034	1.990
0.20	90.0	0.034	1.960
0.25	0.5	3.848	152.115
0.25	1.0	1.927	91.817
0.25	2.0	0.965	50.773
0.25	3.0	0.644	35.044
0.25	4.0	0.483	26.754
0.25	5.0	0.387	21.639
0.25	6.0	0.322	18.168
0.25	8.0	0.242	13.766
0.25	10.0	0.194	11.090
0.25	12.0	0.162	9.295
0.25	15.0	0.130	7.493
0.25	20.0	0.099	5.690
0.25	25.0	0.080	4.614
0.25	30.0	0.067	3.905
0.25	35.0	0.059	3.408
0.25	40.0	0.052	3.043
0.25	45.0	0.048	2.767
0.25	50.0	0.044	2.556
0.25	60.0	0.039	2.262
0.25	70.0	0.036	2.085
0.25	80.0	0.034	1.990
0.25	90.0	0.034	1.960

Goldstone Stations S-Band (Frequency = 2.250 GHz)			
CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.30	0.5	3.845	152.109
0.30	1.0	1.926	91.805
0.30	2.0	0.964	50.769
0.30	3.0	0.643	35.041
0.30	4.0	0.483	26.752
0.30	5.0	0.386	21.637
0.30	6.0	0.322	18.167
0.30	8.0	0.242	13.765
0.30	10.0	0.194	11.090
0.30	12.0	0.162	9.295
0.30	15.0	0.130	7.492
0.30	20.0	0.098	5.689
0.30	25.0	0.080	4.614
0.30	30.0	0.067	3.905
0.30	35.0	0.059	3.407
0.30	40.0	0.052	3.043
0.30	45.0	0.048	2.767
0.30	50.0	0.044	2.555
0.30	60.0	0.039	2.262
0.30	70.0	0.036	2.085
0.30	80.0	0.034	1.990
0.30	90.0	0.034	1.960
0.40	0.5	3.838	152.098
0.40	1.0	1.923	91.786
0.40	2.0	0.963	50.763
0.40	3.0	0.643	35.038
0.40	4.0	0.482	26.751
0.40	5.0	0.386	21.636
0.40	6.0	0.322	18.165
0.40	8.0	0.242	13.764
0.40	10.0	0.194	11.089
0.40	12.0	0.162	9.294
0.40	15.0	0.130	7.492
0.40	20.0	0.098	5.689
0.40	25.0	0.080	4.613
0.40	30.0	0.067	3.905
0.40	35.0	0.059	3.407
0.40	40.0	0.052	3.042
0.40	45.0	0.048	2.767
0.40	50.0	0.044	2.555
0.40	60.0	0.039	2.261
0.40	70.0	0.036	2.085
0.40	80.0	0.034	1.990
0.40	90.0	0.034	1.960

Goldstone Stations S-Band (Frequency = 2.250 GHz)			
CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.50	0.5	3.832	152.096
0.50	1.0	1.921	91.778
0.50	2.0	0.962	50.766
0.50	3.0	0.642	35.043
0.50	4.0	0.482	26.754
0.50	5.0	0.386	21.639
0.50	6.0	0.322	18.168
0.50	8.0	0.242	13.767
0.50	10.0	0.194	11.091
0.50	12.0	0.162	9.296
0.50	15.0	0.130	7.493
0.50	20.0	0.098	5.690
0.50	25.0	0.080	4.614
0.50	30.0	0.067	3.905
0.50	35.0	0.059	3.408
0.50	40.0	0.052	3.043
0.50	45.0	0.048	2.767
0.50	50.0	0.044	2.556
0.50	60.0	0.039	2.262
0.50	70.0	0.036	2.085
0.50	80.0	0.034	1.990
0.50	90.0	0.034	1.960
0.60	0.5	3.826	152.109
0.60	1.0	1.919	91.790
0.60	2.0	0.962	50.784
0.60	3.0	0.642	35.059
0.60	4.0	0.482	26.768
0.60	5.0	0.386	21.651
0.60	6.0	0.322	18.178
0.60	8.0	0.242	13.775
0.60	10.0	0.194	11.097
0.60	12.0	0.162	9.301
0.60	15.0	0.130	7.498
0.60	20.0	0.098	5.693
0.60	25.0	0.080	4.617
0.60	30.0	0.067	3.908
0.60	35.0	0.059	3.410
0.60	40.0	0.052	3.044
0.60	45.0	0.048	2.769
0.60	50.0	0.044	2.557
0.60	60.0	0.039	2.263
0.60	70.0	0.036	2.086
0.60	80.0	0.034	1.991
0.60	90.0	0.034	1.961

Goldstone Stations S-Band (Frequency = 2.250 GHz)			
CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.70	0.5	3.822	152.141
0.70	1.0	1.918	91.825
0.70	2.0	0.962	50.822
0.70	3.0	0.642	35.089
0.70	4.0	0.482	26.793
0.70	5.0	0.386	21.672
0.70	6.0	0.322	18.196
0.70	8.0	0.242	13.789
0.70	10.0	0.194	11.108
0.70	12.0	0.162	9.311
0.70	15.0	0.130	7.505
0.70	20.0	0.098	5.699
0.70	25.0	0.080	4.622
0.70	30.0	0.067	3.912
0.70	35.0	0.059	3.413
0.70	40.0	0.052	3.048
0.70	45.0	0.048	2.772
0.70	50.0	0.044	2.560
0.70	60.0	0.039	2.265
0.70	70.0	0.036	2.088
0.70	80.0	0.034	1.993
0.70	90.0	0.034	1.963
0.80	0.5	3.819	152.201
0.80	1.0	1.917	91.894
0.80	2.0	0.962	50.887
0.80	3.0	0.642	35.141
0.80	4.0	0.482	26.836
0.80	5.0	0.386	21.707
0.80	6.0	0.322	18.226
0.80	8.0	0.242	13.813
0.80	10.0	0.194	11.127
0.80	12.0	0.162	9.327
0.80	15.0	0.130	7.518
0.80	20.0	0.098	5.709
0.80	25.0	0.080	4.630
0.80	30.0	0.067	3.918
0.80	35.0	0.059	3.419
0.80	40.0	0.052	3.053
0.80	45.0	0.048	2.777
0.80	50.0	0.044	2.564
0.80	60.0	0.039	2.269
0.80	70.0	0.036	2.092
0.80	80.0	0.034	1.997
0.80	90.0	0.034	1.966

Goldstone Stations S-Band (Frequency = 2.250 GHz)			
CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.85	0.5	3.818	152.258
0.85	1.0	1.918	91.960
0.85	2.0	0.963	50.944
0.85	3.0	0.643	35.187
0.85	4.0	0.483	26.872
0.85	5.0	0.386	21.738
0.85	6.0	0.322	18.252
0.85	8.0	0.242	13.833
0.85	10.0	0.194	11.143
0.85	12.0	0.162	9.341
0.85	15.0	0.130	7.529
0.85	20.0	0.099	5.717
0.85	25.0	0.080	4.637
0.85	30.0	0.067	3.924
0.85	35.0	0.059	3.424
0.85	40.0	0.052	3.057
0.85	45.0	0.048	2.781
0.85	50.0	0.044	2.568
0.85	60.0	0.039	2.273
0.85	70.0	0.036	2.095
0.85	80.0	0.034	2.000
0.85	90.0	0.034	1.969
0.90	0.5	3.819	152.358
0.90	1.0	1.920	92.076
0.90	2.0	0.964	51.041
0.90	3.0	0.644	35.262
0.90	4.0	0.484	26.933
0.90	5.0	0.387	21.788
0.90	6.0	0.323	18.295
0.90	8.0	0.243	13.867
0.90	10.0	0.194	11.170
0.90	12.0	0.162	9.364
0.90	15.0	0.130	7.548
0.90	20.0	0.099	5.732
0.90	25.0	0.080	4.648
0.90	30.0	0.068	3.934
0.90	35.0	0.059	3.433
0.90	40.0	0.053	3.065
0.90	45.0	0.048	2.788
0.90	50.0	0.044	2.574
0.90	60.0	0.039	2.278
0.90	70.0	0.036	2.100
0.90	80.0	0.034	2.005
0.90	90.0	0.034	1.974

Goldstone Stations S-Band (Frequency = 2.250 GHz)			
CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.92	0.5	3.820	152.435
0.92	1.0	1.921	92.164
0.92	2.0	0.966	51.114
0.92	3.0	0.645	35.319
0.92	4.0	0.484	26.979
0.92	5.0	0.388	21.826
0.92	6.0	0.323	18.328
0.92	8.0	0.243	13.892
0.92	10.0	0.195	11.190
0.92	12.0	0.163	9.381
0.92	15.0	0.131	7.562
0.92	20.0	0.099	5.742
0.92	25.0	0.080	4.657
0.92	30.0	0.068	3.941
0.92	35.0	0.059	3.439
0.92	40.0	0.053	3.071
0.92	45.0	0.048	2.793
0.92	50.0	0.044	2.579
0.92	60.0	0.039	2.283
0.92	70.0	0.036	2.104
0.92	80.0	0.034	2.008
0.92	90.0	0.034	1.978
0.93	0.5	3.822	152.494
0.93	1.0	1.923	92.233
0.93	2.0	0.967	51.171
0.93	3.0	0.646	35.362
0.93	4.0	0.485	27.014
0.93	5.0	0.388	21.855
0.93	6.0	0.324	18.352
0.93	8.0	0.243	13.911
0.93	10.0	0.195	11.206
0.93	12.0	0.163	9.394
0.93	15.0	0.131	7.572
0.93	20.0	0.099	5.750
0.93	25.0	0.080	4.663
0.93	30.0	0.068	3.947
0.93	35.0	0.059	3.444
0.93	40.0	0.053	3.075
0.93	45.0	0.048	2.797
0.93	50.0	0.044	2.583
0.93	60.0	0.039	2.286
0.93	70.0	0.036	2.107
0.93	80.0	0.034	2.011
0.93	90.0	0.034	1.981

Goldstone Stations S-Band (Frequency = 2.250 GHz)			
CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.94	0.5	3.824	152.574
0.94	1.0	1.925	92.325
0.94	2.0	0.968	51.245
0.94	3.0	0.647	35.420
0.94	4.0	0.486	27.060
0.94	5.0	0.389	21.894
0.94	6.0	0.324	18.385
0.94	8.0	0.244	13.937
0.94	10.0	0.195	11.226
0.94	12.0	0.163	9.411
0.94	15.0	0.131	7.587
0.94	20.0	0.099	5.761
0.94	25.0	0.080	4.672
0.94	30.0	0.068	3.954
0.94	35.0	0.059	3.450
0.94	40.0	0.053	3.081
0.94	45.0	0.048	2.802
0.94	50.0	0.044	2.587
0.94	60.0	0.039	2.290
0.94	70.0	0.036	2.111
0.94	80.0	0.034	2.015
0.94	90.0	0.034	1.984
0.95	0.5	3.827	152.688
0.95	1.0	1.928	92.457
0.95	2.0	0.970	51.351
0.95	3.0	0.648	35.502
0.95	4.0	0.487	27.126
0.95	5.0	0.390	21.948
0.95	6.0	0.325	18.431
0.95	8.0	0.244	13.973
0.95	10.0	0.196	11.255
0.95	12.0	0.164	9.436
0.95	15.0	0.131	7.607
0.95	20.0	0.099	5.776
0.95	25.0	0.080	4.684
0.95	30.0	0.068	3.965
0.95	35.0	0.059	3.459
0.95	40.0	0.053	3.089
0.95	45.0	0.048	2.809
0.95	50.0	0.044	2.594
0.95	60.0	0.039	2.296
0.95	70.0	0.036	2.117
0.95	80.0	0.035	2.020
0.95	90.0	0.034	1.990

Goldstone Stations S-Band (Frequency = 2.250 GHz)			
CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.96	0.5	3.833	152.859
0.96	1.0	1.932	92.654
0.96	2.0	0.973	51.511
0.96	3.0	0.650	35.625
0.96	4.0	0.488	27.224
0.96	5.0	0.391	22.030
0.96	6.0	0.326	18.501
0.96	8.0	0.245	14.027
0.96	10.0	0.196	11.299
0.96	12.0	0.164	9.473
0.96	15.0	0.132	7.637
0.96	20.0	0.100	5.799
0.96	25.0	0.081	4.703
0.96	30.0	0.068	3.980
0.96	35.0	0.059	3.473
0.96	40.0	0.053	3.101
0.96	45.0	0.048	2.821
0.96	50.0	0.045	2.605
0.96	60.0	0.039	2.305
0.96	70.0	0.036	2.125
0.96	80.0	0.035	2.028
0.96	90.0	0.034	1.998
0.97	0.5	3.842	153.140
0.97	1.0	1.940	92.978
0.97	2.0	0.978	51.771
0.97	3.0	0.654	35.826
0.97	4.0	0.491	27.385
0.97	5.0	0.393	22.164
0.97	6.0	0.328	18.615
0.97	8.0	0.247	14.116
0.97	10.0	0.198	11.371
0.97	12.0	0.165	9.534
0.97	15.0	0.133	7.686
0.97	20.0	0.100	5.836
0.97	25.0	0.081	4.733
0.97	30.0	0.069	4.006
0.97	35.0	0.060	3.496
0.97	40.0	0.053	3.121
0.97	45.0	0.049	2.839
0.97	50.0	0.045	2.622
0.97	60.0	0.040	2.320
0.97	70.0	0.037	2.139
0.97	80.0	0.035	2.041
0.97	90.0	0.034	2.011

Goldstone Stations S-Band (Frequency = 2.250 GHz)			
CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.98	0.5	3.862	153.721
0.98	1.0	1.955	93.649
0.98	2.0	0.988	52.310
0.98	3.0	0.661	36.241
0.98	4.0	0.497	27.719
0.98	5.0	0.398	22.441
0.98	6.0	0.332	18.851
0.98	8.0	0.250	14.300
0.98	10.0	0.200	11.518
0.98	12.0	0.167	9.659
0.98	15.0	0.134	7.787
0.98	20.0	0.102	5.914
0.98	25.0	0.082	4.796
0.98	30.0	0.069	4.059
0.98	35.0	0.061	3.542
0.98	40.0	0.054	3.163
0.98	45.0	0.049	2.877
0.98	50.0	0.045	2.657
0.98	60.0	0.040	2.351
0.98	70.0	0.037	2.168
0.98	80.0	0.035	2.069
0.98	90.0	0.035	2.037
0.99	0.5	3.909	155.086
0.99	1.0	1.993	95.228
0.99	2.0	1.013	53.580
0.99	3.0	0.679	37.220
0.99	4.0	0.511	28.505
0.99	5.0	0.409	23.094
0.99	6.0	0.341	19.408
0.99	8.0	0.257	14.734
0.99	10.0	0.206	11.867
0.99	12.0	0.172	9.956
0.99	15.0	0.138	8.027
0.99	20.0	0.105	6.096
0.99	25.0	0.085	4.944
0.99	30.0	0.072	4.185
0.99	35.0	0.062	3.652
0.99	40.0	0.056	3.261
0.99	45.0	0.051	2.966
0.99	50.0	0.047	2.739
0.99	60.0	0.041	2.424
0.99	70.0	0.038	2.235
0.99	80.0	0.036	2.133
0.99	90.0	0.036	2.101

Canberra Stations
S-Band (2.250 GHz)

Canberra Stations S-Band (Frequency = 2.250 GHz)			
CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.00	0.5	4.110	158.960
0.00	1.0	2.055	96.949
0.00	2.0	1.028	53.900
0.00	3.0	0.685	37.272
0.00	4.0	0.514	28.481
0.00	5.0	0.412	23.049
0.00	6.0	0.343	19.361
0.00	8.0	0.258	14.676
0.00	10.0	0.207	11.828
0.00	12.0	0.173	9.916
0.00	15.0	0.139	7.995
0.00	20.0	0.105	6.072
0.00	25.0	0.085	4.925
0.00	30.0	0.072	4.169
0.00	35.0	0.063	3.638
0.00	40.0	0.056	3.248
0.00	45.0	0.051	2.955
0.00	50.0	0.047	2.728
0.00	60.0	0.041	2.415
0.00	70.0	0.038	2.226
0.00	80.0	0.036	2.125
0.00	90.0	0.036	2.093
0.10	0.5	4.115	159.312
0.10	1.0	2.062	97.344
0.10	2.0	1.033	54.221
0.10	3.0	0.689	37.520
0.10	4.0	0.517	28.682
0.10	5.0	0.414	23.216
0.10	6.0	0.345	19.502
0.10	8.0	0.259	14.787
0.10	10.0	0.208	11.917
0.10	12.0	0.174	9.991
0.10	15.0	0.139	8.056
0.10	20.0	0.106	6.119
0.10	25.0	0.085	4.963
0.10	30.0	0.072	4.201
0.10	35.0	0.063	3.666
0.10	40.0	0.056	3.273
0.10	45.0	0.051	2.977
0.10	50.0	0.047	2.749
0.10	60.0	0.042	2.433
0.10	70.0	0.038	2.243
0.10	80.0	0.037	2.141
0.10	90.0	0.036	2.109

Canberra Stations S-Band (Frequency = 2.250 GHz)			
CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.20	0.5	4.110	159.361
0.20	1.0	2.060	97.381
0.20	2.0	1.033	54.259
0.20	3.0	0.689	37.551
0.20	4.0	0.517	28.707
0.20	5.0	0.414	23.237
0.20	6.0	0.345	19.520
0.20	8.0	0.259	14.801
0.20	10.0	0.208	11.929
0.20	12.0	0.174	10.001
0.20	15.0	0.139	8.064
0.20	20.0	0.106	6.125
0.20	25.0	0.085	4.968
0.20	30.0	0.072	4.205
0.20	35.0	0.063	3.669
0.20	40.0	0.056	3.276
0.20	45.0	0.051	2.980
0.20	50.0	0.047	2.752
0.20	60.0	0.042	2.436
0.20	70.0	0.038	2.246
0.20	80.0	0.037	2.143
0.20	90.0	0.036	2.111
0.25	0.5	4.106	159.376
0.25	1.0	2.059	97.389
0.25	2.0	1.032	54.270
0.25	3.0	0.689	37.560
0.25	4.0	0.517	28.715
0.25	5.0	0.414	23.243
0.25	6.0	0.345	19.526
0.25	8.0	0.259	14.805
0.25	10.0	0.208	11.932
0.25	12.0	0.174	10.004
0.25	15.0	0.139	8.066
0.25	20.0	0.106	6.126
0.25	25.0	0.085	4.969
0.25	30.0	0.072	4.206
0.25	35.0	0.063	3.670
0.25	40.0	0.056	3.277
0.25	45.0	0.051	2.981
0.25	50.0	0.047	2.753
0.25	60.0	0.042	2.436
0.25	70.0	0.038	2.246
0.25	80.0	0.037	2.144
0.25	90.0	0.036	2.111

Canberra Stations S-Band (Frequency = 2.250 GHz)			
CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.30	0.5	4.103	159.388
0.30	1.0	2.058	97.395
0.30	2.0	1.032	54.278
0.30	3.0	0.689	37.567
0.30	4.0	0.517	28.721
0.30	5.0	0.414	23.249
0.30	6.0	0.345	19.530
0.30	8.0	0.259	14.809
0.30	10.0	0.208	11.935
0.30	12.0	0.174	10.006
0.30	15.0	0.139	8.068
0.30	20.0	0.105	6.128
0.30	25.0	0.085	4.970
0.30	30.0	0.072	4.207
0.30	35.0	0.063	3.671
0.30	40.0	0.056	3.278
0.30	45.0	0.051	2.982
0.30	50.0	0.047	2.753
0.30	60.0	0.042	2.437
0.30	70.0	0.038	2.247
0.30	80.0	0.037	2.144
0.30	90.0	0.036	2.112
0.40	0.5	4.097	159.413
0.40	1.0	2.056	97.408
0.40	2.0	1.031	54.297
0.40	3.0	0.688	37.583
0.40	4.0	0.517	28.734
0.40	5.0	0.414	23.260
0.40	6.0	0.345	19.540
0.40	8.0	0.259	14.817
0.40	10.0	0.208	11.941
0.40	12.0	0.173	10.011
0.40	15.0	0.139	8.072
0.40	20.0	0.105	6.131
0.40	25.0	0.085	4.973
0.40	30.0	0.072	4.209
0.40	35.0	0.063	3.673
0.40	40.0	0.056	3.280
0.40	45.0	0.051	2.983
0.40	50.0	0.047	2.755
0.40	60.0	0.042	2.438
0.40	70.0	0.038	2.248
0.40	80.0	0.037	2.145
0.40	90.0	0.036	2.113

Canberra Stations S-Band (Frequency = 2.250 GHz)			
CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.50	0.5	4.091	159.448
0.50	1.0	2.054	97.434
0.50	2.0	1.031	54.326
0.50	3.0	0.688	37.608
0.50	4.0	0.517	28.755
0.50	5.0	0.414	23.277
0.50	6.0	0.345	19.554
0.50	8.0	0.259	14.828
0.50	10.0	0.208	11.950
0.50	12.0	0.173	10.019
0.50	15.0	0.139	8.078
0.50	20.0	0.105	6.136
0.50	25.0	0.085	4.976
0.50	30.0	0.072	4.212
0.50	35.0	0.063	3.676
0.50	40.0	0.056	3.282
0.50	45.0	0.051	2.985
0.50	50.0	0.047	2.757
0.50	60.0	0.042	2.440
0.50	70.0	0.038	2.250
0.50	80.0	0.037	2.147
0.50	90.0	0.036	2.114
0.60	0.5	4.087	159.505
0.60	1.0	2.053	97.490
0.60	2.0	1.031	54.380
0.60	3.0	0.688	37.651
0.60	4.0	0.517	28.790
0.60	5.0	0.414	23.306
0.60	6.0	0.345	19.579
0.60	8.0	0.259	14.848
0.60	10.0	0.208	11.965
0.60	12.0	0.174	10.032
0.60	15.0	0.139	8.089
0.60	20.0	0.106	6.144
0.60	25.0	0.085	4.983
0.60	30.0	0.072	4.218
0.60	35.0	0.063	3.681
0.60	40.0	0.056	3.287
0.60	45.0	0.051	2.989
0.60	50.0	0.047	2.761
0.60	60.0	0.042	2.443
0.60	70.0	0.038	2.253
0.60	80.0	0.037	2.150
0.60	90.0	0.036	2.117

Canberra Stations S-Band (Frequency = 2.250 GHz)			
CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.70	0.5	4.084	159.603
0.70	1.0	2.054	97.595
0.70	2.0	1.032	54.474
0.70	3.0	0.689	37.725
0.70	4.0	0.517	28.850
0.70	5.0	0.414	23.357
0.70	6.0	0.346	19.622
0.70	8.0	0.260	14.882
0.70	10.0	0.208	11.992
0.70	12.0	0.174	10.055
0.70	15.0	0.140	8.108
0.70	20.0	0.106	6.158
0.70	25.0	0.085	4.995
0.70	30.0	0.072	4.228
0.70	35.0	0.063	3.689
0.70	40.0	0.056	3.294
0.70	45.0	0.051	2.996
0.70	50.0	0.047	2.767
0.70	60.0	0.042	2.449
0.70	70.0	0.038	2.258
0.70	80.0	0.037	2.155
0.70	90.0	0.036	2.122
0.80	0.5	4.085	159.793
0.80	1.0	2.057	97.811
0.80	2.0	1.035	54.657
0.80	3.0	0.691	37.869
0.80	4.0	0.519	28.966
0.80	5.0	0.416	23.453
0.80	6.0	0.347	19.704
0.80	8.0	0.260	14.946
0.80	10.0	0.209	12.044
0.80	12.0	0.174	10.099
0.80	15.0	0.140	8.143
0.80	20.0	0.106	6.185
0.80	25.0	0.086	5.017
0.80	30.0	0.073	4.246
0.80	35.0	0.063	3.705
0.80	40.0	0.056	3.309
0.80	45.0	0.051	3.010
0.80	50.0	0.047	2.779
0.80	60.0	0.042	2.460
0.80	70.0	0.039	2.268
0.80	80.0	0.037	2.164
0.80	90.0	0.036	2.132

Canberra Stations S-Band (Frequency = 2.250 GHz)			
CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.85	0.5	4.088	159.979
0.85	1.0	2.061	98.027
0.85	2.0	1.038	54.837
0.85	3.0	0.694	38.009
0.85	4.0	0.521	29.079
0.85	5.0	0.417	23.547
0.85	6.0	0.348	19.784
0.85	8.0	0.261	15.009
0.85	10.0	0.209	12.094
0.85	12.0	0.175	10.142
0.85	15.0	0.141	8.178
0.85	20.0	0.106	6.211
0.85	25.0	0.086	5.038
0.85	30.0	0.073	4.264
0.85	35.0	0.063	3.721
0.85	40.0	0.057	3.323
0.85	45.0	0.051	3.022
0.85	50.0	0.048	2.791
0.85	60.0	0.042	2.470
0.85	70.0	0.039	2.277
0.85	80.0	0.037	2.174
0.85	90.0	0.036	2.141
0.90	0.5	4.100	160.368
0.90	1.0	2.071	98.484
0.90	2.0	1.045	55.212
0.90	3.0	0.699	38.300
0.90	4.0	0.525	29.313
0.90	5.0	0.420	23.742
0.90	6.0	0.351	19.950
0.90	8.0	0.264	15.139
0.90	10.0	0.211	12.198
0.90	12.0	0.176	10.231
0.90	15.0	0.142	8.249
0.90	20.0	0.107	6.266
0.90	25.0	0.087	5.082
0.90	30.0	0.073	4.302
0.90	35.0	0.064	3.754
0.90	40.0	0.057	3.352
0.90	45.0	0.052	3.049
0.90	50.0	0.048	2.816
0.90	60.0	0.042	2.492
0.90	70.0	0.039	2.298
0.90	80.0	0.037	2.193
0.90	90.0	0.037	2.160

Canberra Stations S-Band (Frequency = 2.250 GHz)			
CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.92	0.5	4.110	160.686
0.92	1.0	2.080	98.859
0.92	2.0	1.050	55.519
0.92	3.0	0.703	38.537
0.92	4.0	0.528	29.504
0.92	5.0	0.423	23.901
0.92	6.0	0.353	20.086
0.92	8.0	0.265	15.245
0.92	10.0	0.212	12.283
0.92	12.0	0.178	10.303
0.92	15.0	0.143	8.308
0.92	20.0	0.108	6.311
0.92	25.0	0.087	5.118
0.92	30.0	0.074	4.333
0.92	35.0	0.064	3.781
0.92	40.0	0.057	3.376
0.92	45.0	0.052	3.071
0.92	50.0	0.048	2.836
0.92	60.0	0.043	2.510
0.92	70.0	0.039	2.314
0.92	80.0	0.037	2.208
0.92	90.0	0.037	2.175
0.93	0.5	4.118	160.918
0.93	1.0	2.086	99.132
0.93	2.0	1.055	55.742
0.93	3.0	0.706	38.710
0.93	4.0	0.530	29.643
0.93	5.0	0.425	24.017
0.93	6.0	0.354	20.185
0.93	8.0	0.266	15.322
0.93	10.0	0.213	12.345
0.93	12.0	0.178	10.355
0.93	15.0	0.143	8.350
0.93	20.0	0.108	6.343
0.93	25.0	0.088	5.145
0.93	30.0	0.074	4.355
0.93	35.0	0.065	3.800
0.93	40.0	0.058	3.394
0.93	45.0	0.052	3.087
0.93	50.0	0.048	2.851
0.93	60.0	0.043	2.523
0.93	70.0	0.039	2.326
0.93	80.0	0.038	2.220
0.93	90.0	0.037	2.186

Canberra Stations S-Band (Frequency = 2.250 GHz)			
CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.94	0.5	4.129	161.230
0.94	1.0	2.095	99.502
0.94	2.0	1.061	56.043
0.94	3.0	0.710	38.944
0.94	4.0	0.534	29.831
0.94	5.0	0.428	24.173
0.94	6.0	0.357	20.318
0.94	8.0	0.268	15.426
0.94	10.0	0.215	12.429
0.94	12.0	0.180	10.427
0.94	15.0	0.144	8.408
0.94	20.0	0.109	6.387
0.94	25.0	0.088	5.181
0.94	30.0	0.075	4.385
0.94	35.0	0.065	3.827
0.94	40.0	0.058	3.417
0.94	45.0	0.053	3.108
0.94	50.0	0.049	2.870
0.94	60.0	0.043	2.541
0.94	70.0	0.040	2.342
0.94	80.0	0.038	2.235
0.94	90.0	0.037	2.202
0.95	0.5	4.137	161.468
0.95	1.0	2.102	99.801
0.95	2.0	1.066	56.305
0.95	3.0	0.714	39.150
0.95	4.0	0.537	29.997
0.95	5.0	0.430	24.312
0.95	6.0	0.359	20.437
0.95	8.0	0.270	15.520
0.95	10.0	0.216	12.503
0.95	12.0	0.181	10.491
0.95	15.0	0.145	8.460
0.95	20.0	0.110	6.426
0.95	25.0	0.089	5.213
0.95	30.0	0.075	4.412
0.95	35.0	0.065	3.851
0.95	40.0	0.058	3.439
0.95	45.0	0.053	3.128
0.95	50.0	0.049	2.888
0.95	60.0	0.043	2.556
0.95	70.0	0.040	2.357
0.95	80.0	0.038	2.249
0.95	90.0	0.038	2.215

Canberra Stations S-Band (Frequency = 2.250 GHz)			
CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.96	0.5	4.164	162.185
0.96	1.0	2.125	100.728
0.96	2.0	1.082	57.135
0.96	3.0	0.726	39.810
0.96	4.0	0.546	30.526
0.96	5.0	0.438	24.752
0.96	6.0	0.365	20.820
0.96	8.0	0.275	15.822
0.96	10.0	0.220	12.742
0.96	12.0	0.184	10.695
0.96	15.0	0.148	8.626
0.96	20.0	0.112	6.553
0.96	25.0	0.091	5.315
0.96	30.0	0.077	4.500
0.96	35.0	0.067	3.927
0.96	40.0	0.060	3.507
0.96	45.0	0.054	3.189
0.96	50.0	0.050	2.945
0.96	60.0	0.044	2.607
0.96	70.0	0.041	2.404
0.96	80.0	0.039	2.294
0.96	90.0	0.038	2.259
0.97	0.5	4.196	163.019
0.97	1.0	2.152	101.807
0.97	2.0	1.102	58.103
0.97	3.0	0.741	40.580
0.97	4.0	0.557	31.143
0.97	5.0	0.447	25.267
0.97	6.0	0.373	21.266
0.97	8.0	0.281	16.175
0.97	10.0	0.225	13.020
0.97	12.0	0.188	10.935
0.97	15.0	0.151	8.820
0.97	20.0	0.114	6.701
0.97	25.0	0.092	5.436
0.97	30.0	0.078	4.602
0.97	35.0	0.068	4.016
0.97	40.0	0.061	3.586
0.97	45.0	0.055	3.262
0.97	50.0	0.051	3.012
0.97	60.0	0.045	2.666
0.97	70.0	0.042	2.458
0.97	80.0	0.040	2.346
0.97	90.0	0.039	2.311

Canberra Stations S-Band (Frequency = 2.250 GHz)			
CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.98	0.5	4.247	164.357
0.98	1.0	2.196	103.542
0.98	2.0	1.134	59.664
0.98	3.0	0.764	41.823
0.98	4.0	0.575	32.141
0.98	5.0	0.461	26.100
0.98	6.0	0.386	21.990
0.98	8.0	0.291	16.746
0.98	10.0	0.232	13.471
0.98	12.0	0.194	11.323
0.98	15.0	0.156	9.134
0.98	20.0	0.118	6.941
0.98	25.0	0.096	5.631
0.98	30.0	0.081	4.767
0.98	35.0	0.070	4.160
0.98	40.0	0.063	3.715
0.98	45.0	0.057	3.380
0.98	50.0	0.053	3.121
0.98	60.0	0.047	2.763
0.98	70.0	0.043	2.547
0.98	80.0	0.041	2.431
0.98	90.0	0.040	2.394
0.99	0.5	4.353	167.025
0.99	1.0	2.286	107.012
0.99	2.0	1.198	62.794
0.99	3.0	0.811	44.324
0.99	4.0	0.612	34.152
0.99	5.0	0.491	27.781
0.99	6.0	0.411	23.449
0.99	8.0	0.310	17.901
0.99	10.0	0.248	14.384
0.99	12.0	0.208	12.109
0.99	15.0	0.167	9.771
0.99	20.0	0.126	7.426
0.99	25.0	0.102	6.026
0.99	30.0	0.086	5.102
0.99	35.0	0.075	4.453
0.99	40.0	0.067	3.977
0.99	45.0	0.061	3.618
0.99	50.0	0.056	3.341
0.99	60.0	0.050	2.957
0.99	70.0	0.046	2.727
0.99	80.0	0.044	2.602
0.99	90.0	0.043	2.563

Madrid Stations
S-Band (2.250 GHz)

Madrid Stations S-Band (Frequency = 2.250 GHz)			
CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.00	0.5	4.037	156.942
0.00	1.0	2.018	95.419
0.00	2.0	1.009	52.955
0.00	3.0	0.673	36.595
0.00	4.0	0.505	27.955
0.00	5.0	0.404	22.619
0.00	6.0	0.337	18.997
0.00	8.0	0.253	14.398
0.00	10.0	0.203	11.603
0.00	12.0	0.169	9.726
0.00	15.0	0.136	7.842
0.00	20.0	0.103	5.955
0.00	25.0	0.083	4.830
0.00	30.0	0.070	4.088
0.00	35.0	0.061	3.567
0.00	40.0	0.055	3.186
0.00	45.0	0.050	2.897
0.00	50.0	0.046	2.676
0.00	60.0	0.041	2.368
0.00	70.0	0.037	2.183
0.00	80.0	0.036	2.084
0.00	90.0	0.035	2.052
0.10	0.5	4.037	157.166
0.10	1.0	2.022	95.660
0.10	2.0	1.012	53.150
0.10	3.0	0.675	36.745
0.10	4.0	0.507	28.077
0.10	5.0	0.406	22.720
0.10	6.0	0.338	19.082
0.10	8.0	0.254	14.465
0.10	10.0	0.204	11.657
0.10	12.0	0.170	9.772
0.10	15.0	0.137	7.878
0.10	20.0	0.103	5.983
0.10	25.0	0.084	4.853
0.10	30.0	0.071	4.108
0.10	35.0	0.062	3.584
0.10	40.0	0.055	3.201
0.10	45.0	0.050	2.911
0.10	50.0	0.046	2.688
0.10	60.0	0.041	2.379
0.10	70.0	0.038	2.194
0.10	80.0	0.036	2.093
0.10	90.0	0.035	2.062

Madrid Stations S-Band (Frequency = 2.250 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.20	0.5	4.031	157.204
0.20	1.0	2.020	95.688
0.20	2.0	1.012	53.181
0.20	3.0	0.675	36.771
0.20	4.0	0.507	28.098
0.20	5.0	0.405	22.738
0.20	6.0	0.338	19.097
0.20	8.0	0.254	14.477
0.20	10.0	0.204	11.666
0.20	12.0	0.170	9.780
0.20	15.0	0.137	7.885
0.20	20.0	0.103	5.988
0.20	25.0	0.084	4.857
0.20	30.0	0.071	4.111
0.20	35.0	0.062	3.587
0.20	40.0	0.055	3.203
0.20	45.0	0.050	2.913
0.20	50.0	0.046	2.690
0.20	60.0	0.041	2.381
0.20	70.0	0.038	2.195
0.20	80.0	0.036	2.095
0.20	90.0	0.035	2.063
0.25	0.5	4.028	157.213
0.25	1.0	2.019	95.691
0.25	2.0	1.011	53.187
0.25	3.0	0.675	36.776
0.25	4.0	0.506	28.103
0.25	5.0	0.405	22.742
0.25	6.0	0.338	19.101
0.25	8.0	0.254	14.480
0.25	10.0	0.203	11.668
0.25	12.0	0.170	9.782
0.25	15.0	0.137	7.886
0.25	20.0	0.103	5.989
0.25	25.0	0.084	4.858
0.25	30.0	0.071	4.112
0.25	35.0	0.062	3.588
0.25	40.0	0.055	3.204
0.25	45.0	0.050	2.914
0.25	50.0	0.046	2.691
0.25	60.0	0.041	2.382
0.25	70.0	0.038	2.196
0.25	80.0	0.036	2.096
0.25	90.0	0.035	2.064

Madrid Stations S-Band (Frequency = 2.250 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.30	0.5	4.025	157.220
0.30	1.0	2.017	95.692
0.30	2.0	1.011	53.192
0.30	3.0	0.675	36.781
0.30	4.0	0.506	28.107
0.30	5.0	0.405	22.745
0.30	6.0	0.338	19.104
0.30	8.0	0.254	14.482
0.30	10.0	0.203	11.670
0.30	12.0	0.170	9.783
0.30	15.0	0.136	7.888
0.30	20.0	0.103	5.990
0.30	25.0	0.084	4.858
0.30	30.0	0.071	4.112
0.30	35.0	0.062	3.588
0.30	40.0	0.055	3.204
0.30	45.0	0.050	2.914
0.30	50.0	0.046	2.691
0.30	60.0	0.041	2.382
0.30	70.0	0.038	2.196
0.30	80.0	0.036	2.096
0.30	90.0	0.035	2.064
0.40	0.5	4.019	157.237
0.40	1.0	2.015	95.698
0.40	2.0	1.010	53.205
0.40	3.0	0.674	36.793
0.40	4.0	0.506	28.117
0.40	5.0	0.405	22.754
0.40	6.0	0.338	19.111
0.40	8.0	0.254	14.488
0.40	10.0	0.203	11.675
0.40	12.0	0.170	9.787
0.40	15.0	0.136	7.891
0.40	20.0	0.103	5.993
0.40	25.0	0.084	4.860
0.40	30.0	0.071	4.114
0.40	35.0	0.062	3.590
0.40	40.0	0.055	3.206
0.40	45.0	0.050	2.916
0.40	50.0	0.046	2.692
0.40	60.0	0.041	2.383
0.40	70.0	0.038	2.197
0.40	80.0	0.036	2.097
0.40	90.0	0.035	2.065

Madrid Stations S-Band (Frequency = 2.250 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.50	0.5	4.013	157.260
0.50	1.0	2.013	95.714
0.50	2.0	1.010	53.226
0.50	3.0	0.674	36.811
0.50	4.0	0.506	28.132
0.50	5.0	0.405	22.767
0.50	6.0	0.338	19.122
0.50	8.0	0.254	14.497
0.50	10.0	0.203	11.682
0.50	12.0	0.170	9.793
0.50	15.0	0.136	7.895
0.50	20.0	0.103	5.996
0.50	25.0	0.084	4.863
0.50	30.0	0.071	4.116
0.50	35.0	0.062	3.592
0.50	40.0	0.055	3.207
0.50	45.0	0.050	2.917
0.50	50.0	0.046	2.694
0.50	60.0	0.041	2.384
0.50	70.0	0.038	2.198
0.50	80.0	0.036	2.098
0.50	90.0	0.035	2.066
0.60	0.5	4.008	157.297
0.60	1.0	2.012	95.748
0.60	2.0	1.009	53.263
0.60	3.0	0.674	36.842
0.60	4.0	0.506	28.157
0.60	5.0	0.405	22.787
0.60	6.0	0.338	19.140
0.60	8.0	0.254	14.511
0.60	10.0	0.203	11.693
0.60	12.0	0.170	9.803
0.60	15.0	0.136	7.903
0.60	20.0	0.103	6.002
0.60	25.0	0.084	4.868
0.60	30.0	0.071	4.120
0.60	35.0	0.062	3.595
0.60	40.0	0.055	3.211
0.60	45.0	0.050	2.920
0.60	50.0	0.046	2.697
0.60	60.0	0.041	2.387
0.60	70.0	0.038	2.200
0.60	80.0	0.036	2.100
0.60	90.0	0.035	2.068

Madrid Stations S-Band (Frequency = 2.250 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.70	0.5	4.004	157.365
0.70	1.0	2.011	95.820
0.70	2.0	1.010	53.330
0.70	3.0	0.674	36.895
0.70	4.0	0.506	28.201
0.70	5.0	0.405	22.824
0.70	6.0	0.338	19.171
0.70	8.0	0.254	14.535
0.70	10.0	0.203	11.712
0.70	12.0	0.170	9.819
0.70	15.0	0.137	7.916
0.70	20.0	0.103	6.012
0.70	25.0	0.084	4.876
0.70	30.0	0.071	4.127
0.70	35.0	0.062	3.601
0.70	40.0	0.055	3.216
0.70	45.0	0.050	2.925
0.70	50.0	0.046	2.701
0.70	60.0	0.041	2.391
0.70	70.0	0.038	2.204
0.70	80.0	0.036	2.103
0.70	90.0	0.035	2.072
0.80	0.5	4.004	157.533
0.80	1.0	2.014	96.012
0.80	2.0	1.012	53.493
0.80	3.0	0.676	37.023
0.80	4.0	0.508	28.304
0.80	5.0	0.406	22.910
0.80	6.0	0.339	19.244
0.80	8.0	0.255	14.593
0.80	10.0	0.204	11.758
0.80	12.0	0.170	9.858
0.80	15.0	0.137	7.948
0.80	20.0	0.104	6.036
0.80	25.0	0.084	4.896
0.80	30.0	0.071	4.144
0.80	35.0	0.062	3.616
0.80	40.0	0.055	3.229
0.80	45.0	0.050	2.937
0.80	50.0	0.046	2.712
0.80	60.0	0.041	2.400
0.80	70.0	0.038	2.213
0.80	80.0	0.036	2.112
0.80	90.0	0.035	2.080

Madrid Stations S-Band (Frequency = 2.250 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.85	0.5	4.009	157.752
0.85	1.0	2.019	96.265
0.85	2.0	1.016	53.703
0.85	3.0	0.679	37.186
0.85	4.0	0.510	28.435
0.85	5.0	0.408	23.019
0.85	6.0	0.340	19.337
0.85	8.0	0.256	14.665
0.85	10.0	0.205	11.816
0.85	12.0	0.171	9.908
0.85	15.0	0.138	7.988
0.85	20.0	0.104	6.067
0.85	25.0	0.084	4.920
0.85	30.0	0.071	4.165
0.85	35.0	0.062	3.634
0.85	40.0	0.055	3.245
0.85	45.0	0.050	2.952
0.85	50.0	0.046	2.726
0.85	60.0	0.041	2.412
0.85	70.0	0.038	2.224
0.85	80.0	0.036	2.123
0.85	90.0	0.036	2.091
0.90	0.5	4.027	158.345
0.90	1.0	2.035	96.960
0.90	2.0	1.026	54.270
0.90	3.0	0.686	37.624
0.90	4.0	0.516	28.788
0.90	5.0	0.413	23.312
0.90	6.0	0.344	19.587
0.90	8.0	0.259	14.860
0.90	10.0	0.207	11.973
0.90	12.0	0.173	10.041
0.90	15.0	0.139	8.096
0.90	20.0	0.105	6.149
0.90	25.0	0.085	4.987
0.90	30.0	0.072	4.221
0.90	35.0	0.063	3.684
0.90	40.0	0.056	3.289
0.90	45.0	0.051	2.992
0.90	50.0	0.047	2.763
0.90	60.0	0.042	2.445
0.90	70.0	0.038	2.254
0.90	80.0	0.037	2.152
0.90	90.0	0.036	2.119

Madrid Stations S-Band (Frequency = 2.250 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.92	0.5	4.045	158.858
0.92	1.0	2.049	97.563
0.92	2.0	1.036	54.760
0.92	3.0	0.693	38.004
0.92	4.0	0.521	29.093
0.92	5.0	0.417	23.566
0.92	6.0	0.348	19.803
0.92	8.0	0.262	15.029
0.92	10.0	0.210	12.108
0.92	12.0	0.175	10.156
0.92	15.0	0.141	8.189
0.92	20.0	0.107	6.220
0.92	25.0	0.086	5.045
0.92	30.0	0.073	4.270
0.92	35.0	0.064	3.726
0.92	40.0	0.057	3.328
0.92	45.0	0.052	3.027
0.92	50.0	0.048	2.795
0.92	60.0	0.042	2.474
0.92	70.0	0.039	2.281
0.92	80.0	0.037	2.177
0.92	90.0	0.036	2.144
0.93	0.5	4.086	160.052
0.93	1.0	2.072	98.546
0.93	2.0	1.049	55.424
0.93	3.0	0.702	38.494
0.93	4.0	0.528	29.478
0.93	5.0	0.423	23.883
0.93	6.0	0.353	20.073
0.93	8.0	0.265	15.238
0.93	10.0	0.212	12.276
0.93	12.0	0.178	10.298
0.93	15.0	0.143	8.304
0.93	20.0	0.108	6.308
0.93	25.0	0.087	5.116
0.93	30.0	0.074	4.331
0.93	35.0	0.064	3.779
0.93	40.0	0.057	3.375
0.93	45.0	0.052	3.069
0.93	50.0	0.048	2.835
0.93	60.0	0.043	2.509
0.93	70.0	0.039	2.313
0.93	80.0	0.037	2.207
0.93	90.0	0.037	2.174

Madrid Stations S-Band (Frequency = 2.250 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.94	0.5	4.072	159.615
0.94	1.0	2.071	98.493
0.94	2.0	1.052	55.554
0.94	3.0	0.705	38.627
0.94	4.0	0.530	29.592
0.94	5.0	0.425	23.982
0.94	6.0	0.354	20.161
0.94	8.0	0.266	15.310
0.94	10.0	0.213	12.332
0.94	12.0	0.178	10.348
0.94	15.0	0.143	8.344
0.94	20.0	0.108	6.338
0.94	25.0	0.088	5.141
0.94	30.0	0.074	4.352
0.94	35.0	0.065	3.797
0.94	40.0	0.058	3.391
0.94	45.0	0.052	3.084
0.94	50.0	0.048	2.848
0.94	60.0	0.043	2.521
0.94	70.0	0.039	2.324
0.94	80.0	0.038	2.218
0.94	90.0	0.037	2.185
0.95	0.5	4.089	160.081
0.95	1.0	2.086	99.087
0.95	2.0	1.062	56.081
0.95	3.0	0.712	39.044
0.95	4.0	0.536	29.927
0.95	5.0	0.429	24.261
0.95	6.0	0.358	20.402
0.95	8.0	0.270	15.501
0.95	10.0	0.216	12.483
0.95	12.0	0.180	10.477
0.95	15.0	0.145	8.449
0.95	20.0	0.110	6.418
0.95	25.0	0.089	5.206
0.95	30.0	0.075	4.407
0.95	35.0	0.065	3.845
0.95	40.0	0.058	3.434
0.95	45.0	0.053	3.123
0.95	50.0	0.049	2.884
0.95	60.0	0.043	2.553
0.95	70.0	0.040	2.354
0.95	80.0	0.038	2.246
0.95	90.0	0.038	2.212

Madrid Stations S-Band (Frequency = 2.250 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.96	0.5	4.110	160.650
0.96	1.0	2.104	99.817
0.96	2.0	1.075	56.733
0.96	3.0	0.722	39.562
0.96	4.0	0.543	30.342
0.96	5.0	0.435	24.607
0.96	6.0	0.364	20.702
0.96	8.0	0.274	15.738
0.96	10.0	0.219	12.669
0.96	12.0	0.183	10.638
0.96	15.0	0.147	8.579
0.96	20.0	0.111	6.517
0.96	25.0	0.090	5.286
0.96	30.0	0.076	4.475
0.96	35.0	0.066	3.905
0.96	40.0	0.059	3.487
0.96	45.0	0.054	3.172
0.96	50.0	0.050	2.929
0.96	60.0	0.044	2.593
0.96	70.0	0.041	2.390
0.96	80.0	0.039	2.281
0.96	90.0	0.038	2.247
0.97	0.5	4.137	161.372
0.97	1.0	2.127	100.747
0.97	2.0	1.092	57.566
0.97	3.0	0.734	40.224
0.97	4.0	0.553	30.873
0.97	5.0	0.443	25.050
0.97	6.0	0.370	21.087
0.97	8.0	0.279	16.042
0.97	10.0	0.223	12.909
0.97	12.0	0.187	10.844
0.97	15.0	0.150	8.746
0.97	20.0	0.113	6.644
0.97	25.0	0.092	5.390
0.97	30.0	0.078	4.563
0.97	35.0	0.068	3.982
0.97	40.0	0.060	3.556
0.97	45.0	0.055	3.234
0.97	50.0	0.051	2.987
0.97	60.0	0.045	2.644
0.97	70.0	0.041	2.437
0.97	80.0	0.039	2.326
0.97	90.0	0.039	2.291

Madrid Stations S-Band (Frequency = 2.250 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.98	0.5	4.177	162.434
0.98	1.0	2.162	102.114
0.98	2.0	1.117	58.791
0.98	3.0	0.753	41.199
0.98	4.0	0.567	31.654
0.98	5.0	0.455	25.702
0.98	6.0	0.380	21.653
0.98	8.0	0.286	16.489
0.98	10.0	0.229	13.262
0.98	12.0	0.192	11.148
0.98	15.0	0.154	8.992
0.98	20.0	0.117	6.832
0.98	25.0	0.094	5.543
0.98	30.0	0.080	4.692
0.98	35.0	0.069	4.095
0.98	40.0	0.062	3.657
0.98	45.0	0.056	3.326
0.98	50.0	0.052	3.072
0.98	60.0	0.046	2.719
0.98	70.0	0.042	2.507
0.98	80.0	0.040	2.393
0.98	90.0	0.040	2.356
0.99	0.5	4.255	164.437
0.99	1.0	2.228	104.698
0.99	2.0	1.164	61.113
0.99	3.0	0.788	43.051
0.99	4.0	0.594	33.142
0.99	5.0	0.477	26.945
0.99	6.0	0.399	22.732
0.99	8.0	0.301	17.343
0.99	10.0	0.240	13.936
0.99	12.0	0.201	11.728
0.99	15.0	0.162	9.462
0.99	20.0	0.122	7.191
0.99	25.0	0.099	5.834
0.99	30.0	0.084	4.940
0.99	35.0	0.073	4.311
0.99	40.0	0.065	3.850
0.99	45.0	0.059	3.502
0.99	50.0	0.055	3.234
0.99	60.0	0.048	2.863
0.99	70.0	0.045	2.640
0.99	80.0	0.043	2.519
0.99	90.0	0.042	2.481

DSN Stations
X-Band (8.450 GHz)

Goldstone Stations
X-Band (8.450 GHz)

Goldstone Stations X-Band (Frequency = 8.450 GHz)			
CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.00	0.5	4.250	161.561
0.00	1.0	2.125	99.104
0.00	2.0	1.063	55.282
0.00	3.0	0.709	38.272
0.00	4.0	0.532	29.264
0.00	5.0	0.425	23.691
0.00	6.0	0.355	19.905
0.00	8.0	0.266	15.094
0.00	10.0	0.214	12.167
0.00	12.0	0.178	10.201
0.00	15.0	0.143	8.226
0.00	20.0	0.108	6.248
0.00	25.0	0.088	5.068
0.00	30.0	0.074	4.290
0.00	35.0	0.065	3.744
0.00	40.0	0.058	3.343
0.00	45.0	0.052	3.041
0.00	50.0	0.048	2.808
0.00	60.0	0.043	2.485
0.00	70.0	0.039	2.291
0.00	80.0	0.038	2.187
0.00	90.0	0.037	2.154
0.10	0.5	4.339	164.046
0.10	1.0	2.195	101.996
0.10	2.0	1.107	57.538
0.10	3.0	0.740	39.997
0.10	4.0	0.556	30.660
0.10	5.0	0.446	24.852
0.10	6.0	0.371	20.883
0.10	8.0	0.279	15.852
0.10	10.0	0.224	12.785
0.10	12.0	0.187	10.722
0.10	15.0	0.150	8.647
0.10	20.0	0.114	6.570
0.10	25.0	0.092	5.330
0.10	30.0	0.078	4.512
0.10	35.0	0.068	3.937
0.10	40.0	0.060	3.516
0.10	45.0	0.055	3.198
0.10	50.0	0.051	2.954
0.10	60.0	0.045	2.614
0.10	70.0	0.041	2.410
0.10	80.0	0.039	2.300
0.10	90.0	0.039	2.265

Goldstone Stations X-Band (Frequency = 8.450 GHz)			
CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.20	0.5	4.367	164.971
0.20	1.0	2.221	103.097
0.20	2.0	1.124	58.448
0.20	3.0	0.753	40.705
0.20	4.0	0.566	31.232
0.20	5.0	0.454	25.328
0.20	6.0	0.378	21.289
0.20	8.0	0.284	16.169
0.20	10.0	0.228	13.041
0.20	12.0	0.190	10.939
0.20	15.0	0.153	8.823
0.20	20.0	0.116	6.704
0.20	25.0	0.094	5.438
0.20	30.0	0.079	4.604
0.20	35.0	0.069	4.018
0.20	40.0	0.062	3.588
0.20	45.0	0.056	3.264
0.20	50.0	0.052	3.014
0.20	60.0	0.046	2.668
0.20	70.0	0.042	2.460
0.20	80.0	0.040	2.348
0.20	90.0	0.040	2.312
0.25	0.5	4.379	165.372
0.25	1.0	2.231	103.570
0.25	2.0	1.132	58.840
0.25	3.0	0.758	41.011
0.25	4.0	0.570	31.478
0.25	5.0	0.457	25.534
0.25	6.0	0.381	21.464
0.25	8.0	0.286	16.306
0.25	10.0	0.230	13.151
0.25	12.0	0.192	11.032
0.25	15.0	0.154	8.899
0.25	20.0	0.117	6.762
0.25	25.0	0.094	5.485
0.25	30.0	0.080	4.644
0.25	35.0	0.070	4.053
0.25	40.0	0.062	3.619
0.25	45.0	0.056	3.292
0.25	50.0	0.052	3.040
0.25	60.0	0.046	2.691
0.25	70.0	0.042	2.481
0.25	80.0	0.040	2.368
0.25	90.0	0.040	2.332

Goldstone Stations X-Band (Frequency = 8.450 GHz)			
CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.30	0.5	4.390	165.757
0.30	1.0	2.241	104.025
0.30	2.0	1.139	59.217
0.30	3.0	0.763	41.304
0.30	4.0	0.574	31.715
0.30	5.0	0.460	25.732
0.30	6.0	0.384	21.632
0.30	8.0	0.289	16.437
0.30	10.0	0.231	13.257
0.30	12.0	0.193	11.122
0.30	15.0	0.155	8.972
0.30	20.0	0.117	6.817
0.30	25.0	0.095	5.531
0.30	30.0	0.080	4.682
0.30	35.0	0.070	4.086
0.30	40.0	0.063	3.649
0.30	45.0	0.057	3.319
0.30	50.0	0.052	3.065
0.30	60.0	0.046	2.713
0.30	70.0	0.043	2.502
0.30	80.0	0.041	2.388
0.30	90.0	0.040	2.351
0.40	0.5	4.414	166.557
0.40	1.0	2.263	104.968
0.40	2.0	1.153	59.997
0.40	3.0	0.774	41.912
0.40	4.0	0.583	32.207
0.40	5.0	0.467	26.141
0.40	6.0	0.389	21.981
0.40	8.0	0.293	16.710
0.40	10.0	0.235	13.477
0.40	12.0	0.196	11.309
0.40	15.0	0.158	9.123
0.40	20.0	0.119	6.933
0.40	25.0	0.097	5.624
0.40	30.0	0.082	4.762
0.40	35.0	0.071	4.156
0.40	40.0	0.063	3.711
0.40	45.0	0.058	3.376
0.40	50.0	0.053	3.118
0.40	60.0	0.047	2.760
0.40	70.0	0.043	2.544
0.40	80.0	0.041	2.428
0.40	90.0	0.041	2.391

Goldstone Stations X-Band (Frequency = 8.450 GHz)			
CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.50	0.5	4.441	167.466
0.50	1.0	2.287	106.044
0.50	2.0	1.170	60.888
0.50	3.0	0.786	42.606
0.50	4.0	0.592	32.768
0.50	5.0	0.475	26.609
0.50	6.0	0.396	22.380
0.50	8.0	0.298	17.022
0.50	10.0	0.239	13.728
0.50	12.0	0.200	11.523
0.50	15.0	0.160	9.296
0.50	20.0	0.121	7.065
0.50	25.0	0.098	5.732
0.50	30.0	0.083	4.853
0.50	35.0	0.072	4.235
0.50	40.0	0.065	3.782
0.50	45.0	0.059	3.440
0.50	50.0	0.054	3.177
0.50	60.0	0.048	2.812
0.50	70.0	0.044	2.593
0.50	80.0	0.042	2.475
0.50	90.0	0.041	2.437
0.60	0.5	4.477	168.574
0.60	1.0	2.318	107.360
0.60	2.0	1.191	61.976
0.60	3.0	0.801	43.455
0.60	4.0	0.604	33.455
0.60	5.0	0.484	27.182
0.60	6.0	0.404	22.869
0.60	8.0	0.304	17.405
0.60	10.0	0.244	14.036
0.60	12.0	0.204	11.785
0.60	15.0	0.164	9.508
0.60	20.0	0.124	7.226
0.60	25.0	0.100	5.863
0.60	30.0	0.085	4.964
0.60	35.0	0.074	4.333
0.60	40.0	0.066	3.869
0.60	45.0	0.060	3.520
0.60	50.0	0.055	3.251
0.60	60.0	0.049	2.877
0.60	70.0	0.045	2.653
0.60	80.0	0.043	2.532
0.60	90.0	0.042	2.494

Goldstone Stations X-Band (Frequency = 8.450 GHz)			
CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.70	0.5	4.523	169.917
0.70	1.0	2.357	108.958
0.70	2.0	1.217	63.301
0.70	3.0	0.820	44.489
0.70	4.0	0.618	34.292
0.70	5.0	0.496	27.881
0.70	6.0	0.414	23.465
0.70	8.0	0.312	17.871
0.70	10.0	0.250	14.412
0.70	12.0	0.209	12.104
0.70	15.0	0.168	9.767
0.70	20.0	0.127	7.424
0.70	25.0	0.103	6.024
0.70	30.0	0.087	5.100
0.70	35.0	0.076	4.452
0.70	40.0	0.068	3.976
0.70	45.0	0.061	3.617
0.70	50.0	0.057	3.340
0.70	60.0	0.050	2.957
0.70	70.0	0.046	2.726
0.70	80.0	0.044	2.602
0.70	90.0	0.043	2.562
0.80	0.5	4.583	171.609
0.80	1.0	2.406	110.979
0.80	2.0	1.250	64.976
0.80	3.0	0.844	45.798
0.80	4.0	0.637	35.353
0.80	5.0	0.511	28.767
0.80	6.0	0.427	24.220
0.80	8.0	0.322	18.463
0.80	10.0	0.258	14.890
0.80	12.0	0.215	12.510
0.80	15.0	0.173	10.096
0.80	20.0	0.131	7.675
0.80	25.0	0.106	6.228
0.80	30.0	0.090	5.274
0.80	35.0	0.078	4.603
0.80	40.0	0.070	4.111
0.80	45.0	0.063	3.740
0.80	50.0	0.058	3.454
0.80	60.0	0.052	3.057
0.80	70.0	0.048	2.819
0.80	80.0	0.045	2.690
0.80	90.0	0.045	2.650

Goldstone Stations X-Band (Frequency = 8.450 GHz)			
CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.85	0.5	4.626	172.771
0.85	1.0	2.441	112.376
0.85	2.0	1.274	66.139
0.85	3.0	0.861	46.710
0.85	4.0	0.650	36.092
0.85	5.0	0.522	29.384
0.85	6.0	0.436	24.748
0.85	8.0	0.328	18.876
0.85	10.0	0.263	15.223
0.85	12.0	0.220	12.794
0.85	15.0	0.177	10.326
0.85	20.0	0.134	7.850
0.85	25.0	0.108	6.371
0.85	30.0	0.091	5.395
0.85	35.0	0.080	4.709
0.85	40.0	0.071	4.206
0.85	45.0	0.065	3.826
0.85	50.0	0.060	3.533
0.85	60.0	0.053	3.128
0.85	70.0	0.049	2.884
0.85	80.0	0.046	2.752
0.85	90.0	0.046	2.711
0.90	0.5	4.690	174.438
0.90	1.0	2.493	114.388
0.90	2.0	1.308	67.818
0.90	3.0	0.885	48.027
0.90	4.0	0.669	37.161
0.90	5.0	0.538	30.278
0.90	6.0	0.449	25.511
0.90	8.0	0.338	19.474
0.90	10.0	0.271	15.706
0.90	12.0	0.227	13.205
0.90	15.0	0.182	10.659
0.90	20.0	0.138	8.105
0.90	25.0	0.112	6.578
0.90	30.0	0.094	5.570
0.90	35.0	0.082	4.862
0.90	40.0	0.073	4.343
0.90	45.0	0.067	3.951
0.90	50.0	0.062	3.649
0.90	60.0	0.054	3.230
0.90	70.0	0.050	2.978
0.90	80.0	0.048	2.843
0.90	90.0	0.047	2.800

Goldstone Stations X-Band (Frequency = 8.450 GHz)			
CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.92	0.5	4.734	175.536
0.92	1.0	2.528	115.721
0.92	2.0	1.331	68.933
0.92	3.0	0.902	48.903
0.92	4.0	0.682	37.873
0.92	5.0	0.548	30.874
0.92	6.0	0.457	26.021
0.92	8.0	0.345	19.874
0.92	10.0	0.276	16.029
0.92	12.0	0.231	13.479
0.92	15.0	0.186	10.881
0.92	20.0	0.141	8.275
0.92	25.0	0.114	6.716
0.92	30.0	0.096	5.688
0.92	35.0	0.084	4.965
0.92	40.0	0.075	4.435
0.92	45.0	0.068	4.034
0.92	50.0	0.063	3.726
0.92	60.0	0.056	3.298
0.92	70.0	0.051	3.041
0.92	80.0	0.049	2.903
0.92	90.0	0.048	2.859
0.93	0.5	4.767	176.335
0.93	1.0	2.554	116.695
0.93	2.0	1.348	69.751
0.93	3.0	0.914	49.546
0.93	4.0	0.692	38.395
0.93	5.0	0.556	31.311
0.93	6.0	0.464	26.395
0.93	8.0	0.350	20.167
0.93	10.0	0.280	16.266
0.93	12.0	0.235	13.681
0.93	15.0	0.188	11.045
0.93	20.0	0.143	8.400
0.93	25.0	0.115	6.818
0.93	30.0	0.098	5.774
0.93	35.0	0.085	5.040
0.93	40.0	0.076	4.502
0.93	45.0	0.069	4.096
0.93	50.0	0.064	3.783
0.93	60.0	0.056	3.349
0.93	70.0	0.052	3.088
0.93	80.0	0.050	2.947
0.93	90.0	0.049	2.902

Goldstone Stations X-Band (Frequency = 8.450 GHz)			
CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.94	0.5	4.809	177.358
0.94	1.0	2.587	117.945
0.94	2.0	1.370	70.802
0.94	3.0	0.930	50.374
0.94	4.0	0.704	39.069
0.94	5.0	0.566	31.876
0.94	6.0	0.472	26.878
0.94	8.0	0.357	20.546
0.94	10.0	0.285	16.572
0.94	12.0	0.239	13.942
0.94	15.0	0.192	11.257
0.94	20.0	0.145	8.562
0.94	25.0	0.118	6.950
0.94	30.0	0.099	5.886
0.94	35.0	0.087	5.138
0.94	40.0	0.077	4.589
0.94	45.0	0.070	4.175
0.94	50.0	0.065	3.856
0.94	60.0	0.057	3.414
0.94	70.0	0.053	3.148
0.94	80.0	0.050	3.004
0.94	90.0	0.050	2.959
0.95	0.5	4.869	178.769
0.95	1.0	2.634	119.675
0.95	2.0	1.401	72.261
0.95	3.0	0.952	51.526
0.95	4.0	0.721	40.007
0.95	5.0	0.580	32.662
0.95	6.0	0.484	27.550
0.95	8.0	0.366	21.074
0.95	10.0	0.293	16.999
0.95	12.0	0.245	14.305
0.95	15.0	0.197	11.552
0.95	20.0	0.149	8.787
0.95	25.0	0.120	7.133
0.95	30.0	0.102	6.042
0.95	35.0	0.089	5.274
0.95	40.0	0.079	4.711
0.95	45.0	0.072	4.286
0.95	50.0	0.066	3.959
0.95	60.0	0.059	3.505
0.95	70.0	0.054	3.231
0.95	80.0	0.052	3.084
0.95	90.0	0.051	3.038

Goldstone Stations X-Band (Frequency = 8.450 GHz)			
CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.96	0.5	4.957	180.816
0.96	1.0	2.704	122.195
0.96	2.0	1.446	74.397
0.96	3.0	0.985	53.215
0.96	4.0	0.747	41.384
0.96	5.0	0.600	33.817
0.96	6.0	0.501	28.540
0.96	8.0	0.379	21.852
0.96	10.0	0.303	17.628
0.96	12.0	0.254	14.841
0.96	15.0	0.204	11.986
0.96	20.0	0.154	9.120
0.96	25.0	0.125	7.404
0.96	30.0	0.106	6.271
0.96	35.0	0.092	5.475
0.96	40.0	0.082	4.891
0.96	45.0	0.075	4.450
0.96	50.0	0.069	4.110
0.96	60.0	0.061	3.638
0.96	70.0	0.056	3.355
0.96	80.0	0.054	3.202
0.96	90.0	0.053	3.154
0.97	0.5	5.100	184.031
0.97	1.0	2.816	126.177
0.97	2.0	1.520	77.798
0.97	3.0	1.038	55.915
0.97	4.0	0.788	43.591
0.97	5.0	0.634	35.670
0.97	6.0	0.529	30.129
0.97	8.0	0.400	23.102
0.97	10.0	0.320	18.640
0.97	12.0	0.268	15.703
0.97	15.0	0.215	12.687
0.97	20.0	0.163	9.655
0.97	25.0	0.132	7.841
0.97	30.0	0.112	6.642
0.97	35.0	0.097	5.799
0.97	40.0	0.087	5.180
0.97	45.0	0.079	4.713
0.97	50.0	0.073	4.354
0.97	60.0	0.064	3.854
0.97	70.0	0.059	3.554
0.97	80.0	0.057	3.392
0.97	90.0	0.056	3.341

Goldstone Stations X-Band (Frequency = 8.450 GHz)			
CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.98	0.5	5.393	190.303
0.98	1.0	3.046	134.030
0.98	2.0	1.670	84.592
0.98	3.0	1.146	61.347
0.98	4.0	0.872	48.048
0.98	5.0	0.702	39.424
0.98	6.0	0.587	33.352
0.98	8.0	0.444	25.644
0.98	10.0	0.355	20.701
0.98	12.0	0.298	17.460
0.98	15.0	0.239	14.115
0.98	20.0	0.181	10.750
0.98	25.0	0.146	8.732
0.98	30.0	0.124	7.399
0.98	35.0	0.108	6.461
0.98	40.0	0.096	5.773
0.98	45.0	0.088	5.253
0.98	50.0	0.081	4.852
0.98	60.0	0.071	4.296
0.98	70.0	0.066	3.962
0.98	80.0	0.063	3.782
0.98	90.0	0.062	3.725
0.99	0.5	6.083	203.506
0.99	1.0	3.586	150.958
0.99	2.0	2.024	99.683
0.99	3.0	1.401	73.605
0.99	4.0	1.069	58.196
0.99	5.0	0.863	48.020
0.99	6.0	0.721	40.766
0.99	8.0	0.547	31.519
0.99	10.0	0.437	25.481
0.99	12.0	0.367	21.544
0.99	15.0	0.295	17.443
0.99	20.0	0.223	13.303
0.99	25.0	0.180	10.816
0.99	30.0	0.153	9.170
0.99	35.0	0.133	8.011
0.99	40.0	0.119	7.160
0.99	45.0	0.108	6.516
0.99	50.0	0.100	6.020
0.99	60.0	0.088	5.332
0.99	70.0	0.081	4.918
0.99	80.0	0.077	4.694
0.99	90.0	0.076	4.624

Canberra Stations
X-Band (8.450 GHz)

Canberra Stations X-Band (Frequency = 8.450 GHz)			
CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.00	0.5	4.532	168.823
0.00	1.0	2.266	104.785
0.00	2.0	1.133	58.851
0.00	3.0	0.756	40.842
0.00	4.0	0.567	31.266
0.00	5.0	0.454	25.331
0.00	6.0	0.378	21.294
0.00	8.0	0.284	16.157
0.00	10.0	0.228	13.029
0.00	12.0	0.190	10.926
0.00	15.0	0.153	8.813
0.00	20.0	0.116	6.696
0.00	25.0	0.094	5.432
0.00	30.0	0.079	4.599
0.00	35.0	0.069	4.013
0.00	40.0	0.062	3.584
0.00	45.0	0.056	3.260
0.00	50.0	0.052	3.011
0.00	60.0	0.046	2.665
0.00	70.0	0.042	2.457
0.00	80.0	0.040	2.345
0.00	90.0	0.040	2.309
0.10	0.5	4.753	174.248
0.10	1.0	2.439	111.479
0.10	2.0	1.245	64.329
0.10	3.0	0.836	45.096
0.10	4.0	0.629	34.715
0.10	5.0	0.504	28.207
0.10	6.0	0.421	23.736
0.10	8.0	0.316	18.062
0.10	10.0	0.254	14.573
0.10	12.0	0.212	12.235
0.10	15.0	0.170	9.873
0.10	20.0	0.129	7.505
0.10	25.0	0.104	6.090
0.10	30.0	0.088	5.157
0.10	35.0	0.077	4.501
0.10	40.0	0.069	4.020
0.10	45.0	0.062	3.657
0.10	50.0	0.058	3.377
0.10	60.0	0.051	2.989
0.10	70.0	0.047	2.756
0.10	80.0	0.045	2.631
0.10	90.0	0.044	2.591

Canberra Stations X-Band (Frequency = 8.450 GHz)			
CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.20	0.5	4.803	175.640
0.20	1.0	2.482	113.186
0.20	2.0	1.273	65.768
0.20	3.0	0.856	46.225
0.20	4.0	0.645	35.631
0.20	5.0	0.517	28.973
0.20	6.0	0.432	24.390
0.20	8.0	0.325	18.574
0.20	10.0	0.260	14.986
0.20	12.0	0.218	12.586
0.20	15.0	0.175	10.158
0.20	20.0	0.132	7.722
0.20	25.0	0.107	6.267
0.20	30.0	0.090	5.307
0.20	35.0	0.079	4.632
0.20	40.0	0.070	4.137
0.20	45.0	0.064	3.763
0.20	50.0	0.059	3.476
0.20	60.0	0.052	3.077
0.20	70.0	0.048	2.837
0.20	80.0	0.046	2.707
0.20	90.0	0.045	2.666
0.25	0.5	4.822	176.222
0.25	1.0	2.499	113.895
0.25	2.0	1.285	66.365
0.25	3.0	0.865	46.694
0.25	4.0	0.652	36.012
0.25	5.0	0.523	29.291
0.25	6.0	0.436	24.662
0.25	8.0	0.328	18.787
0.25	10.0	0.263	15.159
0.25	12.0	0.220	12.732
0.25	15.0	0.177	10.276
0.25	20.0	0.134	7.813
0.25	25.0	0.108	6.341
0.25	30.0	0.091	5.369
0.25	35.0	0.080	4.686
0.25	40.0	0.071	4.186
0.25	45.0	0.065	3.808
0.25	50.0	0.060	3.517
0.25	60.0	0.053	3.113
0.25	70.0	0.049	2.870
0.25	80.0	0.046	2.739
0.25	90.0	0.046	2.698

Canberra Stations X-Band (Frequency = 8.450 GHz)			
CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.30	0.5	4.841	176.773
0.30	1.0	2.515	114.563
0.30	2.0	1.296	66.928
0.30	3.0	0.873	47.136
0.30	4.0	0.658	36.370
0.30	5.0	0.528	29.591
0.30	6.0	0.440	24.918
0.30	8.0	0.332	18.988
0.30	10.0	0.266	15.320
0.30	12.0	0.222	12.870
0.30	15.0	0.178	10.388
0.30	20.0	0.135	7.898
0.30	25.0	0.109	6.410
0.30	30.0	0.092	5.428
0.30	35.0	0.080	4.738
0.30	40.0	0.072	4.232
0.30	45.0	0.065	3.849
0.30	50.0	0.060	3.555
0.30	60.0	0.053	3.147
0.30	70.0	0.049	2.902
0.30	80.0	0.047	2.770
0.30	90.0	0.046	2.728
0.40	0.5	4.879	177.886
0.40	1.0	2.548	115.911
0.40	2.0	1.318	68.064
0.40	3.0	0.889	48.029
0.40	4.0	0.671	37.096
0.40	5.0	0.538	30.198
0.40	6.0	0.449	25.436
0.40	8.0	0.338	19.395
0.40	10.0	0.271	15.649
0.40	12.0	0.226	13.149
0.40	15.0	0.182	10.614
0.40	20.0	0.138	8.071
0.40	25.0	0.111	6.550
0.40	30.0	0.094	5.547
0.40	35.0	0.082	4.842
0.40	40.0	0.073	4.325
0.40	45.0	0.067	3.934
0.40	50.0	0.061	3.634
0.40	60.0	0.054	3.217
0.40	70.0	0.050	2.966
0.40	80.0	0.048	2.831
0.40	90.0	0.047	2.788

Canberra Stations X-Band (Frequency = 8.450 GHz)			
CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.50	0.5	4.922	179.113
0.50	1.0	2.585	117.402
0.50	2.0	1.343	69.323
0.50	3.0	0.907	49.020
0.50	4.0	0.685	37.901
0.50	5.0	0.549	30.872
0.50	6.0	0.458	26.012
0.50	8.0	0.346	19.846
0.50	10.0	0.277	16.013
0.50	12.0	0.231	13.459
0.50	15.0	0.186	10.866
0.50	20.0	0.141	8.263
0.50	25.0	0.114	6.707
0.50	30.0	0.096	5.680
0.50	35.0	0.084	4.958
0.50	40.0	0.075	4.428
0.50	45.0	0.068	4.029
0.50	50.0	0.063	3.721
0.50	60.0	0.056	3.294
0.50	70.0	0.051	3.037
0.50	80.0	0.049	2.899
0.50	90.0	0.048	2.855
0.60	0.5	4.978	180.623
0.60	1.0	2.631	119.248
0.60	2.0	1.375	70.885
0.60	3.0	0.929	50.251
0.60	4.0	0.702	38.903
0.60	5.0	0.564	31.711
0.60	6.0	0.471	26.729
0.60	8.0	0.355	20.409
0.60	10.0	0.284	16.468
0.60	12.0	0.238	13.846
0.60	15.0	0.191	11.179
0.60	20.0	0.144	8.503
0.60	25.0	0.117	6.902
0.60	30.0	0.099	5.845
0.60	35.0	0.086	5.103
0.60	40.0	0.077	4.558
0.60	45.0	0.070	4.146
0.60	50.0	0.064	3.830
0.60	60.0	0.057	3.390
0.60	70.0	0.053	3.126
0.60	80.0	0.050	2.984
0.60	90.0	0.049	2.938

Canberra Stations X-Band (Frequency = 8.450 GHz)			
CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.70	0.5	5.054	182.594
0.70	1.0	2.694	121.676
0.70	2.0	1.417	72.948
0.70	3.0	0.960	51.880
0.70	4.0	0.726	40.231
0.70	5.0	0.583	32.823
0.70	6.0	0.487	27.681
0.70	8.0	0.367	21.156
0.70	10.0	0.294	17.072
0.70	12.0	0.246	14.360
0.70	15.0	0.198	11.596
0.70	20.0	0.149	8.822
0.70	25.0	0.121	7.161
0.70	30.0	0.102	6.065
0.70	35.0	0.089	5.295
0.70	40.0	0.080	4.730
0.70	45.0	0.072	4.303
0.70	50.0	0.067	3.974
0.70	60.0	0.059	3.518
0.70	70.0	0.054	3.244
0.70	80.0	0.052	3.096
0.70	90.0	0.051	3.050
0.80	0.5	5.180	185.603
0.80	1.0	2.795	125.424
0.80	2.0	1.484	76.150
0.80	3.0	1.008	54.418
0.80	4.0	0.763	42.302
0.80	5.0	0.614	34.561
0.80	6.0	0.512	29.169
0.80	8.0	0.387	22.326
0.80	10.0	0.310	18.018
0.80	12.0	0.259	15.166
0.80	15.0	0.208	12.251
0.80	20.0	0.157	9.322
0.80	25.0	0.127	7.569
0.80	30.0	0.108	6.411
0.80	35.0	0.094	5.597
0.80	40.0	0.084	5.000
0.80	45.0	0.076	4.549
0.80	50.0	0.070	4.202
0.80	60.0	0.062	3.720
0.80	70.0	0.057	3.430
0.80	80.0	0.055	3.274
0.80	90.0	0.054	3.224

Canberra Stations X-Band (Frequency = 8.450 GHz)			
CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.85	0.5	5.290	188.095
0.85	1.0	2.883	128.560
0.85	2.0	1.541	78.850
0.85	3.0	1.050	56.566
0.85	4.0	0.795	44.059
0.85	5.0	0.640	36.038
0.85	6.0	0.534	30.435
0.85	8.0	0.404	23.323
0.85	10.0	0.323	18.825
0.85	12.0	0.270	15.854
0.85	15.0	0.217	12.809
0.85	20.0	0.164	9.749
0.85	25.0	0.133	7.917
0.85	30.0	0.112	6.707
0.85	35.0	0.098	5.855
0.85	40.0	0.087	5.231
0.85	45.0	0.080	4.759
0.85	50.0	0.073	4.396
0.85	60.0	0.065	3.892
0.85	70.0	0.060	3.589
0.85	80.0	0.057	3.426
0.85	90.0	0.056	3.374
0.90	0.5	5.506	192.719
0.90	1.0	3.054	134.449
0.90	2.0	1.654	83.976
0.90	3.0	1.130	60.666
0.90	4.0	0.858	47.423
0.90	5.0	0.691	38.870
0.90	6.0	0.577	32.868
0.90	8.0	0.436	25.240
0.90	10.0	0.349	20.379
0.90	12.0	0.292	17.179
0.90	15.0	0.235	13.886
0.90	20.0	0.178	10.574
0.90	25.0	0.144	8.589
0.90	30.0	0.122	7.277
0.90	35.0	0.106	6.355
0.90	40.0	0.095	5.678
0.90	45.0	0.086	5.166
0.90	50.0	0.079	4.772
0.90	60.0	0.070	4.225
0.90	70.0	0.065	3.896
0.90	80.0	0.062	3.719
0.90	90.0	0.061	3.663

Canberra Stations X-Band (Frequency = 8.450 GHz)			
CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.92	0.5	5.678	196.189
0.92	1.0	3.189	138.921
0.92	2.0	1.742	87.917
0.92	3.0	1.194	63.839
0.92	4.0	0.908	50.036
0.92	5.0	0.731	41.076
0.92	6.0	0.611	34.765
0.92	8.0	0.462	26.739
0.92	10.0	0.370	21.596
0.92	12.0	0.310	18.217
0.92	15.0	0.249	14.731
0.92	20.0	0.188	11.221
0.92	25.0	0.152	9.117
0.92	30.0	0.129	7.726
0.92	35.0	0.112	6.747
0.92	40.0	0.100	6.028
0.92	45.0	0.091	5.486
0.92	50.0	0.084	5.067
0.92	60.0	0.074	4.487
0.92	70.0	0.069	4.138
0.92	80.0	0.065	3.950
0.92	90.0	0.064	3.890
0.93	0.5	5.802	198.601
0.93	1.0	3.287	142.054
0.93	2.0	1.806	90.702
0.93	3.0	1.240	66.093
0.93	4.0	0.943	51.897
0.93	5.0	0.760	42.649
0.93	6.0	0.635	36.119
0.93	8.0	0.481	27.811
0.93	10.0	0.384	22.467
0.93	12.0	0.322	18.961
0.93	15.0	0.259	15.337
0.93	20.0	0.196	11.686
0.93	25.0	0.159	9.496
0.93	30.0	0.134	8.048
0.93	35.0	0.117	7.029
0.93	40.0	0.104	6.280
0.93	45.0	0.095	5.715
0.93	50.0	0.087	5.280
0.93	60.0	0.077	4.675
0.93	70.0	0.071	4.312
0.93	80.0	0.068	4.116
0.93	90.0	0.067	4.053

Canberra Stations X-Band (Frequency = 8.450 GHz)			
CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.94	0.5	5.969	201.740
0.94	1.0	3.418	146.160
0.94	2.0	1.892	94.387
0.94	3.0	1.302	69.087
0.94	4.0	0.991	54.376
0.94	5.0	0.799	44.749
0.94	6.0	0.668	37.930
0.94	8.0	0.506	29.246
0.94	10.0	0.404	23.634
0.94	12.0	0.339	19.958
0.94	15.0	0.272	16.149
0.94	20.0	0.206	12.309
0.94	25.0	0.167	10.004
0.94	30.0	0.141	8.480
0.94	35.0	0.123	7.407
0.94	40.0	0.110	6.619
0.94	45.0	0.100	6.023
0.94	50.0	0.092	5.565
0.94	60.0	0.081	4.928
0.94	70.0	0.075	4.545
0.94	80.0	0.072	4.338
0.94	90.0	0.070	4.273
0.95	0.5	6.095	204.008
0.95	1.0	3.521	149.292
0.95	2.0	1.964	97.377
0.95	3.0	1.355	71.571
0.95	4.0	1.032	56.434
0.95	5.0	0.832	46.499
0.95	6.0	0.696	39.459
0.95	8.0	0.528	30.469
0.95	10.0	0.421	24.618
0.95	12.0	0.354	20.806
0.95	15.0	0.284	16.841
0.95	20.0	0.215	12.841
0.95	25.0	0.174	10.438
0.95	30.0	0.147	8.849
0.95	35.0	0.128	7.730
0.95	40.0	0.114	6.908
0.95	45.0	0.104	6.287
0.95	50.0	0.096	5.808
0.95	60.0	0.085	5.144
0.95	70.0	0.078	4.744
0.95	80.0	0.075	4.529
0.95	90.0	0.074	4.460

Canberra Stations X-Band (Frequency = 8.450 GHz)			
CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.96	0.5	6.460	209.912
0.96	1.0	3.830	157.935
0.96	2.0	2.186	106.173
0.96	3.0	1.518	79.024
0.96	4.0	1.158	62.626
0.96	5.0	0.935	51.784
0.96	6.0	0.784	44.120
0.96	8.0	0.596	34.224
0.96	10.0	0.474	27.619
0.96	12.0	0.399	23.410
0.96	15.0	0.320	18.967
0.96	20.0	0.242	14.475
0.96	25.0	0.196	11.774
0.96	30.0	0.166	9.985
0.96	35.0	0.145	8.725
0.96	40.0	0.129	7.799
0.96	45.0	0.117	7.098
0.96	50.0	0.108	6.559
0.96	60.0	0.096	5.809
0.96	70.0	0.088	5.358
0.96	80.0	0.084	5.115
0.96	90.0	0.083	5.038
0.97	0.5	6.888	216.299
0.97	1.0	4.192	167.364
0.97	2.0	2.446	115.926
0.97	3.0	1.709	87.400
0.97	4.0	1.305	69.653
0.97	5.0	1.055	57.817
0.97	6.0	0.886	49.457
0.97	8.0	0.675	38.545
0.97	10.0	0.536	31.087
0.97	12.0	0.452	26.424
0.97	15.0	0.363	21.433
0.97	20.0	0.275	16.376
0.97	25.0	0.222	13.329
0.97	30.0	0.188	11.309
0.97	35.0	0.164	9.885
0.97	40.0	0.146	8.837
0.97	45.0	0.133	8.045
0.97	50.0	0.123	7.435
0.97	60.0	0.108	6.587
0.97	70.0	0.100	6.076
0.97	80.0	0.095	5.801
0.97	90.0	0.094	5.713

Canberra Stations X-Band (Frequency = 8.450 GHz)			
CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.98	0.5	7.581	225.390
0.98	1.0	4.778	181.054
0.98	2.0	2.866	130.526
0.98	3.0	2.019	100.198
0.98	4.0	1.544	80.528
0.98	5.0	1.250	67.231
0.98	6.0	1.053	57.830
0.98	8.0	0.804	45.372
0.98	10.0	0.637	36.593
0.98	12.0	0.538	31.222
0.98	15.0	0.432	25.372
0.98	20.0	0.327	19.422
0.98	25.0	0.264	15.826
0.98	30.0	0.224	13.437
0.98	35.0	0.195	11.750
0.98	40.0	0.174	10.509
0.98	45.0	0.158	9.570
0.98	50.0	0.146	8.846
0.98	60.0	0.129	7.839
0.98	70.0	0.119	7.233
0.98	80.0	0.113	6.905
0.98	90.0	0.112	6.802
0.99	0.5	8.986	240.004
0.99	1.0	5.965	203.812
0.99	2.0	3.718	156.153
0.99	3.0	2.646	123.513
0.99	4.0	2.028	100.822
0.99	5.0	1.644	85.062
0.99	6.0	1.389	73.843
0.99	8.0	1.065	58.594
0.99	10.0	0.840	47.364
0.99	12.0	0.711	40.655
0.99	15.0	0.571	33.160
0.99	20.0	0.432	25.478
0.99	25.0	0.350	20.807
0.99	30.0	0.296	17.692
0.99	35.0	0.258	15.488
0.99	40.0	0.230	13.863
0.99	45.0	0.209	12.631
0.99	50.0	0.193	11.680
0.99	60.0	0.171	10.357
0.99	70.0	0.157	9.559
0.99	80.0	0.150	9.129
0.99	90.0	0.148	8.992

Madrid Stations
X-Band (8.450 GHz)

DSN Madrid Station (Frequency = 8.45 GHz)			
CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.00	0.5	4.448	166.716
0.00	1.0	2.224	103.120
0.00	2.0	1.112	57.800
0.00	3.0	0.742	40.084
0.00	4.0	0.556	30.675
0.00	5.0	0.445	24.846
0.00	6.0	0.371	20.883
0.00	8.0	0.279	15.843
0.00	10.0	0.224	12.774
0.00	12.0	0.187	10.712
0.00	15.0	0.150	8.639
0.00	20.0	0.113	6.564
0.00	25.0	0.092	5.325
0.00	30.0	0.078	4.508
0.00	35.0	0.068	3.934
0.00	40.0	0.060	3.513
0.00	45.0	0.055	3.195
0.00	50.0	0.051	2.951
0.00	60.0	0.045	2.612
0.00	70.0	0.041	2.408
0.00	80.0	0.039	2.298
0.00	90.0	0.039	2.263
0.10	0.5	4.599	170.565
0.10	1.0	2.342	107.776
0.10	2.0	1.188	61.548
0.10	3.0	0.796	42.978
0.10	4.0	0.598	33.020
0.10	5.0	0.480	26.800
0.10	6.0	0.400	22.538
0.10	8.0	0.301	17.130
0.10	10.0	0.241	13.820
0.10	12.0	0.201	11.596
0.10	15.0	0.162	9.356
0.10	20.0	0.122	7.110
0.10	25.0	0.099	5.769
0.10	30.0	0.084	4.884
0.10	35.0	0.073	4.263
0.10	40.0	0.065	3.807
0.10	45.0	0.059	3.463
0.10	50.0	0.055	3.198
0.10	60.0	0.048	2.831
0.10	70.0	0.045	2.610
0.10	80.0	0.042	2.491
0.10	90.0	0.042	2.453

DSN Madrid Station (Frequency = 8.45 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.20	0.5	4.644	171.879
0.20	1.0	2.381	109.376
0.20	2.0	1.214	62.887
0.20	3.0	0.815	44.025
0.20	4.0	0.613	33.868
0.20	5.0	0.492	27.508
0.20	6.0	0.410	23.141
0.20	8.0	0.308	17.603
0.20	10.0	0.247	14.201
0.20	12.0	0.207	11.920
0.20	15.0	0.166	9.618
0.20	20.0	0.126	7.310
0.20	25.0	0.102	5.932
0.20	30.0	0.086	5.022
0.20	35.0	0.075	4.383
0.20	40.0	0.067	3.915
0.20	45.0	0.061	3.561
0.20	50.0	0.056	3.289
0.20	60.0	0.050	2.911
0.20	70.0	0.046	2.684
0.20	80.0	0.044	2.562
0.20	90.0	0.043	2.523
0.25	0.5	4.662	172.411
0.25	1.0	2.396	110.017
0.25	2.0	1.224	63.423
0.25	3.0	0.822	44.445
0.25	4.0	0.619	34.208
0.25	5.0	0.496	27.792
0.25	6.0	0.414	23.384
0.25	8.0	0.311	17.792
0.25	10.0	0.250	14.354
0.25	12.0	0.209	12.050
0.25	15.0	0.168	9.723
0.25	20.0	0.127	7.391
0.25	25.0	0.103	5.997
0.25	30.0	0.087	5.078
0.25	35.0	0.076	4.432
0.25	40.0	0.067	3.958
0.25	45.0	0.061	3.600
0.25	50.0	0.057	3.325
0.25	60.0	0.050	2.943
0.25	70.0	0.046	2.714
0.25	80.0	0.044	2.590
0.25	90.0	0.043	2.551

DSN Madrid Station (Frequency = 8.45 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.30	0.5	4.678	172.923
0.30	1.0	2.411	110.633
0.30	2.0	1.234	63.939
0.30	3.0	0.829	44.849
0.30	4.0	0.625	34.535
0.30	5.0	0.501	28.065
0.30	6.0	0.418	23.617
0.30	8.0	0.314	17.975
0.30	10.0	0.252	14.501
0.30	12.0	0.211	12.175
0.30	15.0	0.169	9.824
0.30	20.0	0.128	7.468
0.30	25.0	0.104	6.060
0.30	30.0	0.088	5.131
0.30	35.0	0.076	4.478
0.30	40.0	0.068	4.000
0.30	45.0	0.062	3.638
0.30	50.0	0.057	3.360
0.30	60.0	0.051	2.974
0.30	70.0	0.047	2.742
0.30	80.0	0.044	2.617
0.30	90.0	0.044	2.578
0.40	0.5	4.713	173.985
0.40	1.0	2.441	111.912
0.40	2.0	1.255	65.009
0.40	3.0	0.844	45.687
0.40	4.0	0.636	35.215
0.40	5.0	0.510	28.633
0.40	6.0	0.426	24.101
0.40	8.0	0.321	18.354
0.40	10.0	0.257	14.807
0.40	12.0	0.215	12.435
0.40	15.0	0.172	10.035
0.40	20.0	0.131	7.629
0.40	25.0	0.106	6.191
0.40	30.0	0.089	5.242
0.40	35.0	0.078	4.575
0.40	40.0	0.069	4.086
0.40	45.0	0.063	3.717
0.40	50.0	0.058	3.433
0.40	60.0	0.052	3.039
0.40	70.0	0.048	2.802
0.40	80.0	0.045	2.674
0.40	90.0	0.045	2.634

DSN Madrid Station (Frequency = 8.45 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.50	0.5	4.751	175.119
0.50	1.0	2.474	113.280
0.50	2.0	1.278	66.156
0.50	3.0	0.861	46.587
0.50	4.0	0.649	35.945
0.50	5.0	0.521	29.243
0.50	6.0	0.434	24.622
0.50	8.0	0.327	18.763
0.50	10.0	0.262	15.136
0.50	12.0	0.219	12.715
0.50	15.0	0.176	10.262
0.50	20.0	0.133	7.802
0.50	25.0	0.108	6.332
0.50	30.0	0.091	5.362
0.50	35.0	0.079	4.680
0.50	40.0	0.071	4.180
0.50	45.0	0.064	3.802
0.50	50.0	0.059	3.512
0.50	60.0	0.053	3.109
0.50	70.0	0.048	2.866
0.50	80.0	0.046	2.736
0.50	90.0	0.046	2.694
0.60	0.5	4.798	176.439
0.60	1.0	2.514	114.877
0.60	2.0	1.304	67.496
0.60	3.0	0.880	47.639
0.60	4.0	0.664	36.799
0.60	5.0	0.533	29.957
0.60	6.0	0.445	25.232
0.60	8.0	0.335	19.241
0.60	10.0	0.268	15.522
0.60	12.0	0.224	13.043
0.60	15.0	0.180	10.528
0.60	20.0	0.136	8.005
0.60	25.0	0.110	6.497
0.60	30.0	0.093	5.502
0.60	35.0	0.081	4.802
0.60	40.0	0.073	4.289
0.60	45.0	0.066	3.902
0.60	50.0	0.061	3.604
0.60	60.0	0.054	3.190
0.60	70.0	0.050	2.941
0.60	80.0	0.047	2.807
0.60	90.0	0.047	2.765

DSN Madrid Station (Frequency = 8.45 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.70	0.5	4.860	178.122
0.70	1.0	2.565	116.925
0.70	2.0	1.338	69.219
0.70	3.0	0.905	48.994
0.70	4.0	0.683	37.900
0.70	5.0	0.549	30.878
0.70	6.0	0.458	26.019
0.70	8.0	0.345	19.858
0.70	10.0	0.276	16.020
0.70	12.0	0.231	13.467
0.70	15.0	0.186	10.872
0.70	20.0	0.141	8.268
0.70	25.0	0.114	6.711
0.70	30.0	0.096	5.683
0.70	35.0	0.084	4.961
0.70	40.0	0.075	4.431
0.70	45.0	0.068	4.031
0.70	50.0	0.063	3.723
0.70	60.0	0.056	3.296
0.70	70.0	0.051	3.039
0.70	80.0	0.049	2.900
0.70	90.0	0.048	2.856
0.80	0.5	4.974	180.971
0.80	1.0	2.657	120.432
0.80	2.0	1.399	72.185
0.80	3.0	0.949	51.332
0.80	4.0	0.717	39.803
0.80	5.0	0.576	32.472
0.80	6.0	0.481	27.382
0.80	8.0	0.363	20.928
0.80	10.0	0.291	16.885
0.80	12.0	0.243	14.203
0.80	15.0	0.195	11.469
0.80	20.0	0.148	8.724
0.80	25.0	0.120	7.082
0.80	30.0	0.101	5.998
0.80	35.0	0.088	5.236
0.80	40.0	0.079	4.677
0.80	45.0	0.072	4.255
0.80	50.0	0.066	3.930
0.80	60.0	0.058	3.479
0.80	70.0	0.054	3.208
0.80	80.0	0.051	3.062
0.80	90.0	0.051	3.016

DSN Madrid Station (Frequency = 8.45 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.85	0.5	5.100	183.913
0.85	1.0	2.758	124.098
0.85	2.0	1.465	75.309
0.85	3.0	0.996	53.806
0.85	4.0	0.754	41.821
0.85	5.0	0.606	34.165
0.85	6.0	0.506	28.832
0.85	8.0	0.382	22.067
0.85	10.0	0.306	17.807
0.85	12.0	0.256	14.988
0.85	15.0	0.206	12.106
0.85	20.0	0.156	9.211
0.85	25.0	0.126	7.479
0.85	30.0	0.107	6.335
0.85	35.0	0.093	5.530
0.85	40.0	0.083	4.940
0.85	45.0	0.075	4.495
0.85	50.0	0.070	4.151
0.85	60.0	0.061	3.675
0.85	70.0	0.057	3.389
0.85	80.0	0.054	3.235
0.85	90.0	0.053	3.186
0.90	0.5	5.420	190.854
0.90	1.0	3.009	132.870
0.90	2.0	1.631	82.891
0.90	3.0	1.115	59.852
0.90	4.0	0.847	46.773
0.90	5.0	0.681	38.331
0.90	6.0	0.569	32.407
0.90	8.0	0.431	24.883
0.90	10.0	0.344	20.088
0.90	12.0	0.288	16.932
0.90	15.0	0.232	13.686
0.90	20.0	0.175	10.420
0.90	25.0	0.142	8.464
0.90	30.0	0.120	7.171
0.90	35.0	0.105	6.262
0.90	40.0	0.093	5.594
0.90	45.0	0.085	5.090
0.90	50.0	0.078	4.702
0.90	60.0	0.069	4.163
0.90	70.0	0.064	3.839
0.90	80.0	0.061	3.664
0.90	90.0	0.060	3.609

DSN Madrid Station (Frequency = 8.45 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.92	0.5	5.691	196.327
0.92	1.0	3.223	139.894
0.92	2.0	1.770	89.073
0.92	3.0	1.215	64.830
0.92	4.0	0.924	50.873
0.92	5.0	0.745	41.792
0.92	6.0	0.622	35.384
0.92	8.0	0.471	27.235
0.92	10.0	0.377	21.998
0.92	12.0	0.316	18.562
0.92	15.0	0.254	15.012
0.92	20.0	0.192	11.437
0.92	25.0	0.155	9.293
0.92	30.0	0.131	7.875
0.92	35.0	0.114	6.878
0.92	40.0	0.102	6.145
0.92	45.0	0.093	5.592
0.92	50.0	0.086	5.166
0.92	60.0	0.076	4.574
0.92	70.0	0.070	4.219
0.92	80.0	0.067	4.027
0.92	90.0	0.066	3.966
0.93	0.5	5.828	198.972
0.93	1.0	3.322	143.081
0.93	2.0	1.836	91.909
0.93	3.0	1.263	67.135
0.93	4.0	0.961	52.765
0.93	5.0	0.775	43.391
0.93	6.0	0.648	36.775
0.93	8.0	0.491	28.342
0.93	10.0	0.392	22.887
0.93	12.0	0.329	19.327
0.93	15.0	0.264	15.635
0.93	20.0	0.200	11.915
0.93	25.0	0.162	9.683
0.93	30.0	0.137	8.207
0.93	35.0	0.119	7.168
0.93	40.0	0.106	6.405
0.93	45.0	0.097	5.828
0.93	50.0	0.089	5.384
0.93	60.0	0.079	4.768
0.93	70.0	0.073	4.397
0.93	80.0	0.069	4.197
0.93	90.0	0.068	4.134

DSN Madrid Station (Frequency = 8.45 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.94	0.5	6.082	203.471
0.94	1.0	3.541	149.609
0.94	2.0	1.989	98.236
0.94	3.0	1.375	72.394
0.94	4.0	1.047	57.128
0.94	5.0	0.845	47.101
0.94	6.0	0.707	40.008
0.94	8.0	0.537	30.925
0.94	10.0	0.428	24.969
0.94	12.0	0.360	21.119
0.94	15.0	0.289	17.096
0.94	20.0	0.219	13.037
0.94	25.0	0.177	10.599
0.94	30.0	0.149	8.985
0.94	35.0	0.130	7.849
0.94	40.0	0.116	7.015
0.94	45.0	0.106	6.384
0.94	50.0	0.098	5.898
0.94	60.0	0.086	5.224
0.94	70.0	0.080	4.818
0.94	80.0	0.076	4.599
0.94	90.0	0.075	4.530
0.95	0.5	6.319	207.416
0.95	1.0	3.740	155.254
0.95	2.0	2.131	103.879
0.95	3.0	1.479	77.156
0.95	4.0	1.128	61.086
0.95	5.0	0.911	50.477
0.95	6.0	0.763	42.980
0.95	8.0	0.580	33.316
0.95	10.0	0.462	26.883
0.95	12.0	0.388	22.778
0.95	15.0	0.312	18.450
0.95	20.0	0.236	14.078
0.95	25.0	0.191	11.449
0.95	30.0	0.161	9.709
0.95	35.0	0.141	8.483
0.95	40.0	0.126	7.582
0.95	45.0	0.114	6.901
0.95	50.0	0.105	6.376
0.95	60.0	0.093	5.648
0.95	70.0	0.086	5.209
0.95	80.0	0.082	4.973
0.95	90.0	0.081	4.898

DSN Madrid Station (Frequency = 8.45 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.96	0.5	6.608	211.932
0.96	1.0	3.984	161.824
0.96	2.0	2.306	110.587
0.96	3.0	1.608	82.880
0.96	4.0	1.227	65.870
0.96	5.0	0.992	54.575
0.96	6.0	0.832	46.599
0.96	8.0	0.634	36.240
0.96	10.0	0.504	29.227
0.96	12.0	0.424	24.813
0.96	15.0	0.341	20.114
0.96	20.0	0.258	15.360
0.96	25.0	0.209	12.498
0.96	30.0	0.176	10.601
0.96	35.0	0.154	9.264
0.96	40.0	0.137	8.282
0.96	45.0	0.125	7.539
0.96	50.0	0.115	6.966
0.96	60.0	0.102	6.171
0.96	70.0	0.094	5.692
0.96	80.0	0.090	5.434
0.96	90.0	0.088	5.352
0.97	0.5	6.975	217.243
0.97	1.0	4.295	169.665
0.97	2.0	2.529	118.766
0.97	3.0	1.772	89.950
0.97	4.0	1.354	71.824
0.97	5.0	1.095	59.699
0.97	6.0	0.921	51.141
0.97	8.0	0.702	39.927
0.97	10.0	0.557	32.189
0.97	12.0	0.470	27.390
0.97	15.0	0.377	22.225
0.97	20.0	0.285	16.988
0.97	25.0	0.231	13.831
0.97	30.0	0.195	11.736
0.97	35.0	0.170	10.259
0.97	40.0	0.152	9.173
0.97	45.0	0.138	8.351
0.97	50.0	0.127	7.718
0.97	60.0	0.113	6.838
0.97	70.0	0.104	6.308
0.97	80.0	0.099	6.022
0.97	90.0	0.098	5.932

DSN Madrid Station (Frequency = 8.45 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.98	0.5	7.520	224.359
0.98	1.0	4.755	180.307
0.98	2.0	2.860	130.110
0.98	3.0	2.016	99.911
0.98	4.0	1.542	80.302
0.98	5.0	1.248	67.045
0.98	6.0	1.051	57.677
0.98	8.0	0.803	45.259
0.98	10.0	0.636	36.494
0.98	12.0	0.537	31.142
0.98	15.0	0.431	25.306
0.98	20.0	0.326	19.372
0.98	25.0	0.264	15.785
0.98	30.0	0.223	13.402
0.98	35.0	0.195	11.720
0.98	40.0	0.174	10.482
0.98	45.0	0.158	9.545
0.98	50.0	0.146	8.823
0.98	60.0	0.129	7.819
0.98	70.0	0.119	7.214
0.98	80.0	0.113	6.888
0.98	90.0	0.112	6.784
0.99	0.5	8.559	235.713
0.99	1.0	5.633	197.755
0.99	2.0	3.489	149.519
0.99	3.0	2.479	117.448
0.99	4.0	1.899	95.501
0.99	5.0	1.539	80.364
0.99	6.0	1.300	69.618
0.99	8.0	0.996	55.096
0.99	10.0	0.786	44.494
0.99	12.0	0.665	38.142
0.99	15.0	0.534	31.080
0.99	20.0	0.404	23.857
0.99	25.0	0.327	19.471
0.99	30.0	0.277	16.550
0.99	35.0	0.241	14.484
0.99	40.0	0.215	12.962
0.99	45.0	0.196	11.808
0.99	50.0	0.181	10.918
0.99	60.0	0.160	9.680
0.99	70.0	0.147	8.933
0.99	80.0	0.140	8.530
0.99	90.0	0.138	8.403

DSN Stations
Ka-Band (32.05 GHz)

Goldstone Stations
Ka-Band (32.05 GHz)

DSN Goldstone Stations (Frequency = 32.05 GHz)			
CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.00	0.5	13.493	256.150
0.00	1.0	6.747	206.456
0.00	2.0	3.374	139.241
0.00	3.0	2.250	103.635
0.00	4.0	1.688	82.307
0.00	5.0	1.351	68.206
0.00	6.0	1.126	58.219
0.00	8.0	0.846	45.039
0.00	10.0	0.678	36.748
0.00	12.0	0.566	31.062
0.00	15.0	0.455	25.253
0.00	20.0	0.344	19.339
0.00	25.0	0.279	15.763
0.00	30.0	0.235	13.386
0.00	35.0	0.205	11.707
0.00	40.0	0.183	10.472
0.00	45.0	0.167	9.537
0.00	50.0	0.154	8.815
0.00	60.0	0.136	7.813
0.00	70.0	0.125	7.209
0.00	80.0	0.120	6.883
0.00	90.0	0.118	6.779
0.10	0.5	14.730	261.494
0.10	1.0	7.690	219.910
0.10	2.0	3.963	156.289
0.10	3.0	2.667	119.156
0.10	4.0	2.013	96.034
0.10	5.0	1.615	80.261
0.10	6.0	1.346	68.759
0.10	8.0	1.013	53.593
0.10	10.0	0.813	43.921
0.10	12.0	0.679	37.218
0.10	15.0	0.545	30.328
0.10	20.0	0.413	23.281
0.10	25.0	0.334	19.002
0.10	30.0	0.282	16.152
0.10	35.0	0.246	14.136
0.10	40.0	0.220	12.650
0.10	45.0	0.200	11.524
0.10	50.0	0.184	10.656
0.10	60.0	0.163	9.447
0.10	70.0	0.150	8.719
0.10	80.0	0.143	8.326
0.10	90.0	0.141	8.201

DSN Goldstone Stations (Frequency = 32.05 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.20	0.5	15.200	263.625
0.20	1.0	8.068	224.834
0.20	2.0	4.213	163.032
0.20	3.0	2.848	125.531
0.20	4.0	2.153	101.728
0.20	5.0	1.729	85.312
0.20	6.0	1.441	73.253
0.20	8.0	1.086	57.296
0.20	10.0	0.871	47.001
0.20	12.0	0.728	39.891
0.20	15.0	0.585	32.540
0.20	20.0	0.443	25.005
0.20	25.0	0.358	20.422
0.20	30.0	0.303	17.365
0.20	35.0	0.264	15.202
0.20	40.0	0.235	13.607
0.20	45.0	0.214	12.398
0.20	50.0	0.198	11.465
0.20	60.0	0.175	10.167
0.20	70.0	0.161	9.384
0.20	80.0	0.154	8.961
0.20	90.0	0.151	8.827
0.25	0.5	15.402	264.564
0.25	1.0	8.232	226.897
0.25	2.0	4.321	165.871
0.25	3.0	2.926	128.237
0.25	4.0	2.214	104.157
0.25	5.0	1.779	87.474
0.25	6.0	1.483	75.182
0.25	8.0	1.118	58.891
0.25	10.0	0.896	48.330
0.25	12.0	0.749	41.046
0.25	15.0	0.602	33.497
0.25	20.0	0.455	25.751
0.25	25.0	0.369	21.037
0.25	30.0	0.312	17.892
0.25	35.0	0.272	15.665
0.25	40.0	0.242	14.022
0.25	45.0	0.220	12.778
0.25	50.0	0.203	11.816
0.25	60.0	0.180	10.479
0.25	70.0	0.166	9.672
0.25	80.0	0.158	9.237
0.25	90.0	0.156	9.099

DSN Goldstone Stations (Frequency = 32.05 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.30	0.5	15.595	265.465
0.30	1.0	8.388	228.836
0.30	2.0	4.425	168.551
0.30	3.0	3.001	130.804
0.30	4.0	2.272	106.469
0.30	5.0	1.826	89.536
0.30	6.0	1.523	77.025
0.30	8.0	1.148	60.417
0.30	10.0	0.920	49.603
0.30	12.0	0.770	42.154
0.30	15.0	0.618	34.416
0.30	20.0	0.468	26.469
0.30	25.0	0.379	21.629
0.30	30.0	0.320	18.398
0.30	35.0	0.279	16.110
0.30	40.0	0.249	14.422
0.30	45.0	0.226	13.143
0.30	50.0	0.209	12.155
0.30	60.0	0.185	10.780
0.30	70.0	0.170	9.950
0.30	80.0	0.163	9.503
0.30	90.0	0.160	9.361
0.40	0.5	15.995	267.273
0.40	1.0	8.712	232.685
0.40	2.0	4.640	173.917
0.40	3.0	3.155	135.984
0.40	4.0	2.392	111.159
0.40	5.0	1.924	93.733
0.40	6.0	1.605	80.784
0.40	8.0	1.211	63.538
0.40	10.0	0.970	52.213
0.40	12.0	0.812	44.428
0.40	15.0	0.652	36.303
0.40	20.0	0.494	27.945
0.40	25.0	0.399	22.847
0.40	30.0	0.338	19.441
0.40	35.0	0.294	17.027
0.40	40.0	0.263	15.246
0.40	45.0	0.239	13.895
0.40	50.0	0.220	12.852
0.40	60.0	0.195	11.400
0.40	70.0	0.180	10.524
0.40	80.0	0.171	10.050
0.40	90.0	0.169	9.901

DSN Goldstone Stations (Frequency = 32.05 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.50	0.5	16.451	269.175
0.50	1.0	9.078	236.760
0.50	2.0	4.883	179.715
0.50	3.0	3.330	141.655
0.50	4.0	2.528	116.332
0.50	5.0	2.034	98.386
0.50	6.0	1.698	84.966
0.50	8.0	1.283	67.027
0.50	10.0	1.027	55.139
0.50	12.0	0.860	46.981
0.50	15.0	0.691	38.427
0.50	20.0	0.523	29.609
0.50	25.0	0.423	24.221
0.50	30.0	0.357	20.618
0.50	35.0	0.312	18.063
0.50	40.0	0.278	16.177
0.50	45.0	0.253	14.746
0.50	50.0	0.233	13.641
0.50	60.0	0.206	12.101
0.50	70.0	0.190	11.172
0.50	80.0	0.182	10.671
0.50	90.0	0.179	10.512
0.60	0.5	17.007	271.260
0.60	1.0	9.524	241.303
0.60	2.0	5.177	186.347
0.60	3.0	3.543	148.241
0.60	4.0	2.693	122.396
0.60	5.0	2.168	103.874
0.60	6.0	1.810	89.919
0.60	8.0	1.369	71.180
0.60	10.0	1.096	58.635
0.60	12.0	0.918	50.038
0.60	15.0	0.737	40.976
0.60	20.0	0.558	31.610
0.60	25.0	0.451	25.877
0.60	30.0	0.382	22.038
0.60	35.0	0.333	19.313
0.60	40.0	0.297	17.301
0.60	45.0	0.270	15.774
0.60	50.0	0.249	14.593
0.60	60.0	0.220	12.949
0.60	70.0	0.203	11.956
0.60	80.0	0.194	11.420
0.60	90.0	0.191	11.250

DSN Goldstone Stations (Frequency = 32.05 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.70	0.5	17.684	273.517
0.70	1.0	10.064	246.281
0.70	2.0	5.534	193.836
0.70	3.0	3.800	155.820
0.70	4.0	2.892	129.452
0.70	5.0	2.331	110.305
0.70	6.0	1.947	95.754
0.70	8.0	1.473	76.105
0.70	10.0	1.179	62.798
0.70	12.0	0.988	53.688
0.70	15.0	0.793	44.027
0.70	20.0	0.600	34.013
0.70	25.0	0.486	27.868
0.70	30.0	0.411	23.747
0.70	35.0	0.358	20.820
0.70	40.0	0.319	18.656
0.70	45.0	0.290	17.013
0.70	50.0	0.268	15.742
0.70	60.0	0.237	13.972
0.70	70.0	0.219	12.902
0.70	80.0	0.209	12.325
0.70	90.0	0.205	12.142
0.80	0.5	18.543	275.999
0.80	1.0	10.747	251.832
0.80	2.0	5.985	202.498
0.80	3.0	4.124	164.788
0.80	4.0	3.144	137.916
0.80	5.0	2.535	118.091
0.80	6.0	2.118	102.863
0.80	8.0	1.605	82.150
0.80	10.0	1.284	67.936
0.80	12.0	1.076	58.207
0.80	15.0	0.864	47.818
0.80	20.0	0.654	37.008
0.80	25.0	0.529	30.355
0.80	30.0	0.447	25.885
0.80	35.0	0.390	22.705
0.80	40.0	0.348	20.353
0.80	45.0	0.316	18.566
0.80	50.0	0.292	17.183
0.80	60.0	0.258	15.255
0.80	70.0	0.238	14.090
0.80	80.0	0.227	13.461
0.80	90.0	0.224	13.261

DSN Goldstone Stations (Frequency = 32.05 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.85	0.5	19.141	277.454
0.85	1.0	11.221	255.215
0.85	2.0	6.298	208.013
0.85	3.0	4.350	170.637
0.85	4.0	3.319	143.513
0.85	5.0	2.678	123.285
0.85	6.0	2.238	107.637
0.85	8.0	1.697	86.243
0.85	10.0	1.356	71.431
0.85	12.0	1.138	61.292
0.85	15.0	0.914	50.415
0.85	20.0	0.692	39.067
0.85	25.0	0.560	32.068
0.85	30.0	0.473	27.360
0.85	35.0	0.412	24.007
0.85	40.0	0.368	21.526
0.85	45.0	0.334	19.639
0.85	50.0	0.309	18.179
0.85	60.0	0.273	16.143
0.85	70.0	0.252	14.912
0.85	80.0	0.240	14.247
0.85	90.0	0.237	14.036
0.90	0.5	20.010	279.234
0.90	1.0	11.908	259.506
0.90	2.0	6.750	215.312
0.90	3.0	4.675	178.560
0.90	4.0	3.571	151.200
0.90	5.0	2.883	130.482
0.90	6.0	2.411	114.293
0.90	8.0	1.829	91.991
0.90	10.0	1.462	76.367
0.90	12.0	1.226	65.661
0.90	15.0	0.985	54.106
0.90	20.0	0.745	42.002
0.90	25.0	0.603	34.515
0.90	30.0	0.510	29.468
0.90	35.0	0.444	25.871
0.90	40.0	0.397	23.205
0.90	45.0	0.361	21.177
0.90	50.0	0.333	19.607
0.90	60.0	0.294	17.416
0.90	70.0	0.271	16.091
0.90	80.0	0.259	15.375
0.90	90.0	0.255	15.148

DSN Goldstone Stations (Frequency = 32.05 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.92	0.5	20.592	280.215
0.92	1.0	12.367	262.002
0.92	2.0	7.052	219.762
0.92	3.0	4.892	183.510
0.92	4.0	3.740	156.070
0.92	5.0	3.020	135.083
0.92	6.0	2.526	118.574
0.92	8.0	1.917	95.717
0.92	10.0	1.532	79.584
0.92	12.0	1.285	68.517
0.92	15.0	1.033	56.526
0.92	20.0	0.781	43.934
0.92	25.0	0.632	36.128
0.92	30.0	0.534	30.861
0.92	35.0	0.466	27.102
0.92	40.0	0.416	24.316
0.92	45.0	0.378	22.195
0.92	50.0	0.349	20.553
0.92	60.0	0.309	18.260
0.92	70.0	0.284	16.873
0.92	80.0	0.271	16.123
0.92	90.0	0.267	15.885
0.93	0.5	21.020	280.850
0.93	1.0	12.704	263.673
0.93	2.0	7.273	222.839
0.93	3.0	5.052	186.991
0.93	4.0	3.863	159.527
0.93	5.0	3.121	138.371
0.93	6.0	2.610	121.647
0.93	8.0	1.982	98.406
0.93	10.0	1.583	81.913
0.93	12.0	1.329	70.590
0.93	15.0	1.067	58.287
0.93	20.0	0.808	45.343
0.93	25.0	0.654	37.307
0.93	30.0	0.553	31.879
0.93	35.0	0.482	28.003
0.93	40.0	0.430	25.129
0.93	45.0	0.391	22.940
0.93	50.0	0.361	21.245
0.93	60.0	0.319	18.877
0.93	70.0	0.294	17.445
0.93	80.0	0.281	16.670
0.93	90.0	0.276	16.425

DSN Goldstone Stations (Frequency = 32.05 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.94	0.5	21.574	281.592
0.94	1.0	13.140	265.659
0.94	2.0	7.560	226.592
0.94	3.0	5.258	191.302
0.94	4.0	4.023	163.849
0.94	5.0	3.251	142.504
0.94	6.0	2.719	125.526
0.94	8.0	2.066	101.818
0.94	10.0	1.650	84.878
0.94	12.0	1.385	73.235
0.94	15.0	1.113	60.538
0.94	20.0	0.842	47.148
0.94	25.0	0.681	38.818
0.94	30.0	0.576	33.185
0.94	35.0	0.502	29.160
0.94	40.0	0.448	26.174
0.94	45.0	0.407	23.898
0.94	50.0	0.376	22.135
0.94	60.0	0.332	19.672
0.94	70.0	0.306	18.182
0.94	80.0	0.292	17.375
0.94	90.0	0.288	17.120
0.95	0.5	22.347	282.502
0.95	1.0	13.748	268.139
0.95	2.0	7.960	231.448
0.95	3.0	5.546	196.996
0.95	4.0	4.246	169.625
0.95	5.0	3.433	148.071
0.95	6.0	2.872	130.780
0.95	8.0	2.183	106.470
0.95	10.0	1.743	88.941
0.95	12.0	1.463	76.869
0.95	15.0	1.175	63.641
0.95	20.0	0.890	49.642
0.95	25.0	0.720	40.911
0.95	30.0	0.608	34.997
0.95	35.0	0.530	30.766
0.95	40.0	0.473	27.624
0.95	45.0	0.430	25.229
0.95	50.0	0.397	23.372
0.95	60.0	0.351	20.777
0.95	70.0	0.324	19.206
0.95	80.0	0.309	18.356
0.95	90.0	0.304	18.086

DSN Goldstone Stations (Frequency = 32.05 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.96	0.5	23.489	283.637
0.96	1.0	14.646	271.277
0.96	2.0	8.549	237.879
0.96	3.0	5.970	204.756
0.96	4.0	4.575	177.633
0.96	5.0	3.700	155.878
0.96	6.0	3.096	138.206
0.96	8.0	2.355	113.111
0.96	10.0	1.880	94.778
0.96	12.0	1.579	82.110
0.96	15.0	1.268	68.135
0.96	20.0	0.960	53.271
0.96	25.0	0.777	43.964
0.96	30.0	0.656	37.643
0.96	35.0	0.572	33.114
0.96	40.0	0.511	29.746
0.96	45.0	0.464	27.177
0.96	50.0	0.428	25.184
0.96	60.0	0.379	22.397
0.96	70.0	0.349	20.708
0.96	80.0	0.333	19.794
0.96	90.0	0.328	19.504
0.97	0.5	25.329	285.073
0.97	1.0	16.093	275.288
0.97	2.0	9.500	246.671
0.97	3.0	6.654	215.840
0.97	4.0	5.106	189.379
0.97	5.0	4.132	167.527
0.97	6.0	3.459	149.424
0.97	8.0	2.633	123.294
0.97	10.0	2.101	103.822
0.97	12.0	1.765	90.281
0.97	15.0	1.418	75.188
0.97	20.0	1.073	59.005
0.97	25.0	0.868	48.805
0.97	30.0	0.734	41.851
0.97	35.0	0.640	36.855
0.97	40.0	0.571	33.132
0.97	45.0	0.519	30.289
0.97	50.0	0.479	28.080
0.97	60.0	0.424	24.988
0.97	70.0	0.391	23.113
0.97	80.0	0.373	22.097
0.97	90.0	0.367	21.775

DSN Goldstone Stations (Frequency = 32.05 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.98	0.5	29.099	287.037
0.98	1.0	19.056	280.726
0.98	2.0	11.446	259.963
0.98	3.0	8.054	233.966
0.98	4.0	6.192	209.530
0.98	5.0	5.015	188.158
0.98	6.0	4.201	169.744
0.98	8.0	3.201	142.260
0.98	10.0	2.553	120.989
0.98	12.0	2.146	105.972
0.98	15.0	1.724	88.900
0.98	20.0	1.305	70.288
0.98	25.0	1.056	58.403
0.98	30.0	0.892	50.234
0.98	35.0	0.778	44.332
0.98	40.0	0.694	39.918
0.98	45.0	0.631	36.535
0.98	50.0	0.583	33.902
0.98	60.0	0.515	30.208
0.98	70.0	0.475	27.963
0.98	80.0	0.453	26.745
0.98	90.0	0.446	26.359
0.99	0.5	37.939	289.284
0.99	1.0	26.003	286.388
0.99	2.0	16.011	276.372
0.99	3.0	11.339	260.126
0.99	4.0	8.738	241.689
0.99	5.0	7.087	223.395
0.99	6.0	5.941	206.182
0.99	8.0	4.535	178.406
0.99	10.0	3.613	155.100
0.99	12.0	3.041	137.958
0.99	15.0	2.443	117.626
0.99	20.0	1.848	94.583
0.99	25.0	1.496	79.408
0.99	30.0	1.264	68.777
0.99	35.0	1.102	60.998
0.99	40.0	0.984	55.125
0.99	45.0	0.894	50.594
0.99	50.0	0.825	47.049
0.99	60.0	0.730	42.048
0.99	70.0	0.673	38.993
0.99	80.0	0.642	37.331
0.99	90.0	0.632	36.803

Canberra Stations
Ka-Band (32.05 GHz)

DSN Canberra Stations (Frequency = 32.05 GHz)			
CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.00	0.5	14.391	260.161
0.00	1.0	7.196	213.403
0.00	2.0	3.598	146.179
0.00	3.0	2.400	109.504
0.00	4.0	1.800	87.272
0.00	5.0	1.441	72.479
0.00	6.0	1.201	61.959
0.00	8.0	0.902	48.023
0.00	10.0	0.723	39.229
0.00	12.0	0.604	33.184
0.00	15.0	0.485	26.999
0.00	20.0	0.367	20.693
0.00	25.0	0.297	16.874
0.00	30.0	0.251	14.334
0.00	35.0	0.219	12.539
0.00	40.0	0.195	11.218
0.00	45.0	0.178	10.217
0.00	50.0	0.164	9.445
0.00	60.0	0.145	8.372
0.00	70.0	0.134	7.725
0.00	80.0	0.128	7.376
0.00	90.0	0.126	7.266
0.10	0.5	17.323	268.697
0.10	1.0	9.469	238.745
0.10	2.0	5.058	182.692
0.10	3.0	3.443	144.513
0.10	4.0	2.611	118.907
0.10	5.0	2.100	100.696
0.10	6.0	1.752	87.055
0.10	8.0	1.323	68.744
0.10	10.0	1.060	56.611
0.10	12.0	0.887	48.254
0.10	15.0	0.712	39.493
0.10	20.0	0.539	30.449
0.10	25.0	0.436	24.918
0.10	30.0	0.369	21.217
0.10	35.0	0.321	18.591
0.10	40.0	0.287	16.652
0.10	45.0	0.261	15.180
0.10	50.0	0.241	14.043
0.10	60.0	0.213	12.460
0.10	70.0	0.196	11.504
0.10	80.0	0.187	10.988
0.10	90.0	0.184	10.824

DSN Canberra Stations (Frequency = 32.05 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.20	0.5	18.076	270.863
0.20	1.0	10.070	244.074
0.20	2.0	5.455	191.038
0.20	3.0	3.729	152.985
0.20	4.0	2.833	126.786
0.20	5.0	2.281	107.870
0.20	6.0	1.904	93.558
0.20	8.0	1.439	74.225
0.20	10.0	1.152	61.237
0.20	12.0	0.965	52.308
0.20	15.0	0.775	42.879
0.20	20.0	0.586	33.113
0.20	25.0	0.475	27.125
0.20	30.0	0.401	23.110
0.20	35.0	0.350	20.259
0.20	40.0	0.312	18.152
0.20	45.0	0.284	16.552
0.20	50.0	0.262	15.315
0.20	60.0	0.232	13.592
0.20	70.0	0.213	12.551
0.20	80.0	0.204	11.989
0.20	90.0	0.201	11.811
0.25	0.5	18.388	271.795
0.25	1.0	10.320	246.190
0.25	2.0	5.621	194.366
0.25	3.0	3.848	156.404
0.25	4.0	2.925	129.993
0.25	5.0	2.356	110.805
0.25	6.0	1.967	96.229
0.25	8.0	1.488	76.487
0.25	10.0	1.191	63.153
0.25	12.0	0.997	53.990
0.25	15.0	0.801	44.288
0.25	20.0	0.606	34.224
0.25	25.0	0.491	28.046
0.25	30.0	0.415	23.901
0.25	35.0	0.362	20.956
0.25	40.0	0.323	18.779
0.25	45.0	0.293	17.126
0.25	50.0	0.271	15.847
0.25	60.0	0.239	14.066
0.25	70.0	0.221	12.990
0.25	80.0	0.211	12.409
0.25	90.0	0.207	12.224

DSN Canberra Stations (Frequency = 32.05 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.30	0.5	18.681	272.683
0.30	1.0	10.556	248.127
0.30	2.0	5.776	197.415
0.30	3.0	3.960	159.557
0.30	4.0	3.012	132.963
0.30	5.0	2.427	113.532
0.30	6.0	2.027	98.716
0.30	8.0	1.533	78.598
0.30	10.0	1.227	64.945
0.30	12.0	1.028	55.565
0.30	15.0	0.826	45.608
0.30	20.0	0.625	35.266
0.30	25.0	0.506	28.910
0.30	30.0	0.427	24.645
0.30	35.0	0.373	21.612
0.30	40.0	0.332	19.369
0.30	45.0	0.302	17.666
0.30	50.0	0.279	16.348
0.30	60.0	0.247	14.512
0.30	70.0	0.227	13.402
0.30	80.0	0.217	12.803
0.30	90.0	0.214	12.613
0.40	0.5	19.273	274.425
0.40	1.0	11.030	251.832
0.40	2.0	6.090	203.313
0.40	3.0	4.187	165.727
0.40	4.0	3.188	138.817
0.40	5.0	2.570	118.935
0.40	6.0	2.147	103.659
0.40	8.0	1.625	82.814
0.40	10.0	1.300	68.533
0.40	12.0	1.090	58.725
0.40	15.0	0.875	48.261
0.40	20.0	0.662	37.365
0.40	25.0	0.536	30.654
0.40	30.0	0.453	26.144
0.40	35.0	0.395	22.935
0.40	40.0	0.352	20.560
0.40	45.0	0.320	18.756
0.40	50.0	0.296	17.359
0.40	60.0	0.262	15.413
0.40	70.0	0.241	14.236
0.40	80.0	0.230	13.601
0.40	90.0	0.227	13.399

DSN Canberra Stations (Frequency = 32.05 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.50	0.5	19.928	276.204
0.50	1.0	11.554	255.577
0.50	2.0	6.437	209.409
0.50	3.0	4.436	172.215
0.50	4.0	3.382	145.040
0.50	5.0	2.728	124.718
0.50	6.0	2.279	108.977
0.50	8.0	1.727	87.378
0.50	10.0	1.381	72.434
0.50	12.0	1.158	62.169
0.50	15.0	0.930	51.162
0.50	20.0	0.704	39.665
0.50	25.0	0.570	32.568
0.50	30.0	0.481	27.792
0.50	35.0	0.420	24.390
0.50	40.0	0.374	21.871
0.50	45.0	0.340	19.956
0.50	50.0	0.314	18.473
0.50	60.0	0.278	16.405
0.50	70.0	0.256	15.155
0.50	80.0	0.244	14.480
0.50	90.0	0.241	14.265
0.60	0.5	20.745	278.120
0.60	1.0	12.205	259.685
0.60	2.0	6.867	216.344
0.60	3.0	4.746	179.765
0.60	4.0	3.622	152.379
0.60	5.0	2.923	131.598
0.60	6.0	2.443	115.344
0.60	8.0	1.853	92.884
0.60	10.0	1.481	77.164
0.60	12.0	1.242	66.358
0.60	15.0	0.998	54.702
0.60	20.0	0.755	42.482
0.60	25.0	0.611	34.917
0.60	30.0	0.516	29.817
0.60	35.0	0.450	26.180
0.60	40.0	0.402	23.484
0.60	45.0	0.365	21.433
0.60	50.0	0.337	19.845
0.60	60.0	0.298	17.629
0.60	70.0	0.275	16.288
0.60	80.0	0.262	15.564
0.60	90.0	0.258	15.334

DSN Canberra Stations (Frequency = 32.05 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.70	0.5	21.829	280.228
0.70	1.0	13.066	264.320
0.70	2.0	7.435	224.551
0.70	3.0	5.155	188.963
0.70	4.0	3.939	161.477
0.70	5.0	3.181	140.225
0.70	6.0	2.660	123.393
0.70	8.0	2.019	99.913
0.70	10.0	1.613	83.244
0.70	12.0	1.354	71.765
0.70	15.0	1.087	59.290
0.70	20.0	0.823	46.149
0.70	25.0	0.666	37.983
0.70	30.0	0.563	32.464
0.70	35.0	0.491	28.522
0.70	40.0	0.438	25.597
0.70	45.0	0.398	23.370
0.70	50.0	0.367	21.644
0.70	60.0	0.325	19.234
0.70	70.0	0.299	17.776
0.70	80.0	0.286	16.987
0.70	90.0	0.281	16.737
0.80	0.5	23.532	282.716
0.80	1.0	14.413	270.038
0.80	2.0	8.322	235.437
0.80	3.0	5.794	201.705
0.80	4.0	4.435	174.407
0.80	5.0	3.584	152.693
0.80	6.0	2.998	135.162
0.80	8.0	2.278	110.341
0.80	10.0	1.819	92.353
0.80	12.0	1.528	79.914
0.80	15.0	1.227	66.249
0.80	20.0	0.929	51.747
0.80	25.0	0.751	42.680
0.80	30.0	0.635	36.530
0.80	35.0	0.554	32.126
0.80	40.0	0.494	28.853
0.80	45.0	0.449	26.357
0.80	50.0	0.415	24.421
0.80	60.0	0.367	21.714
0.80	70.0	0.338	20.075
0.80	80.0	0.322	19.188
0.80	90.0	0.318	18.906

DSN Canberra Stations (Frequency = 32.05 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.85	0.5	24.989	284.258
0.85	1.0	15.562	273.761
0.85	2.0	9.078	243.143
0.85	3.0	6.338	211.185
0.85	4.0	4.857	184.314
0.85	5.0	3.928	162.429
0.85	6.0	3.287	144.476
0.85	8.0	2.499	118.731
0.85	10.0	1.995	99.764
0.85	12.0	1.676	86.589
0.85	15.0	1.346	71.991
0.85	20.0	1.019	56.398
0.85	25.0	0.824	46.600
0.85	30.0	0.697	39.932
0.85	35.0	0.607	35.148
0.85	40.0	0.542	31.586
0.85	45.0	0.493	28.867
0.85	50.0	0.455	26.757
0.85	60.0	0.402	23.803
0.85	70.0	0.371	22.013
0.85	80.0	0.354	21.044
0.85	90.0	0.348	20.736
0.90	0.5	27.811	286.278
0.90	1.0	17.783	278.862
0.90	2.0	10.538	254.823
0.90	3.0	7.388	226.502
0.90	4.0	5.671	200.944
0.90	5.0	4.590	179.190
0.90	6.0	3.843	160.800
0.90	8.0	2.926	133.761
0.90	10.0	2.334	113.238
0.90	12.0	1.962	98.835
0.90	15.0	1.576	82.627
0.90	20.0	1.193	65.097
0.90	25.0	0.965	53.973
0.90	30.0	0.816	46.356
0.90	35.0	0.711	40.868
0.90	40.0	0.635	36.770
0.90	45.0	0.577	33.636
0.90	50.0	0.532	31.198
0.90	60.0	0.471	27.781
0.90	70.0	0.434	25.707
0.90	80.0	0.414	24.582
0.90	90.0	0.408	24.226

DSN Canberra Stations (Frequency = 32.05 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.92	0.5	30.030	287.338
0.92	1.0	19.529	281.575
0.92	2.0	11.685	261.737
0.92	3.0	8.214	236.273
0.92	4.0	6.311	212.043
0.92	5.0	5.111	190.712
0.92	6.0	4.281	172.260
0.92	8.0	3.261	144.588
0.92	10.0	2.601	123.115
0.92	12.0	2.187	107.907
0.92	15.0	1.756	90.597
0.92	20.0	1.329	71.689
0.92	25.0	1.076	59.597
0.92	30.0	0.909	51.278
0.92	35.0	0.793	45.264
0.92	40.0	0.707	40.764
0.92	45.0	0.643	37.315
0.92	50.0	0.593	34.629
0.92	60.0	0.525	30.860
0.92	70.0	0.484	28.569
0.92	80.0	0.462	27.326
0.92	90.0	0.455	26.932
0.93	0.5	31.626	287.929
0.93	1.0	20.784	283.058
0.93	2.0	12.509	265.770
0.93	3.0	8.806	242.285
0.93	4.0	6.771	219.103
0.93	5.0	5.485	198.205
0.93	6.0	4.595	179.829
0.93	8.0	3.502	151.878
0.93	10.0	2.792	129.853
0.93	12.0	2.348	114.146
0.93	15.0	1.886	96.124
0.93	20.0	1.427	76.299
0.93	25.0	1.155	63.550
0.93	30.0	0.976	54.749
0.93	35.0	0.851	48.371
0.93	40.0	0.759	43.591
0.93	45.0	0.690	39.923
0.93	50.0	0.637	37.064
0.93	60.0	0.564	33.049
0.93	70.0	0.520	30.605
0.93	80.0	0.496	29.279
0.93	90.0	0.488	28.857

DSN Canberra Stations (Frequency = 32.05 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.94	0.5	33.772	288.564
0.94	1.0	22.470	284.607
0.94	2.0	13.617	270.212
0.94	3.0	9.604	249.247
0.94	4.0	7.389	227.541
0.94	5.0	5.988	207.351
0.94	6.0	5.017	189.209
0.94	8.0	3.825	161.082
0.94	10.0	3.050	138.470
0.94	12.0	2.565	122.186
0.94	15.0	2.061	103.305
0.94	20.0	1.559	82.339
0.94	25.0	1.262	68.755
0.94	30.0	1.067	59.333
0.94	35.0	0.930	52.485
0.94	40.0	0.830	47.341
0.94	45.0	0.754	43.386
0.94	50.0	0.696	40.301
0.94	60.0	0.616	35.960
0.94	70.0	0.568	33.316
0.94	80.0	0.542	31.880
0.94	90.0	0.533	31.423
0.95	0.5	35.442	288.916
0.95	1.0	23.849	285.512
0.95	2.0	14.580	273.000
0.95	3.0	10.308	253.981
0.95	4.0	7.934	233.619
0.95	5.0	6.431	214.176
0.95	6.0	5.394	196.391
0.95	8.0	4.116	168.381
0.95	10.0	3.278	145.416
0.95	12.0	2.759	128.782
0.95	15.0	2.216	109.281
0.95	20.0	1.677	87.436
0.95	25.0	1.357	73.183
0.95	30.0	1.147	63.256
0.95	35.0	1.000	56.018
0.95	40.0	0.892	50.570
0.95	45.0	0.811	46.376
0.95	50.0	0.749	43.098
0.95	60.0	0.662	38.483
0.95	70.0	0.610	35.668
0.95	80.0	0.583	34.138
0.95	90.0	0.574	33.652

DSN Canberra Stations (Frequency = 32.05 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.96	0.5	40.367	289.243
0.96	1.0	28.009	286.683
0.96	2.0	17.566	278.690
0.96	3.0	12.507	265.291
0.96	4.0	9.630	248.921
0.96	5.0	7.814	232.073
0.96	6.0	6.574	216.082
0.96	8.0	5.031	189.200
0.96	10.0	3.991	165.315
0.96	12.0	3.368	148.082
0.96	15.0	2.706	126.992
0.96	20.0	2.047	102.738
0.96	25.0	1.657	86.582
0.96	30.0	1.400	75.182
0.96	35.0	1.221	66.799
0.96	40.0	1.089	60.449
0.96	45.0	0.990	55.538
0.96	50.0	0.914	51.687
0.96	60.0	0.809	46.244
0.96	70.0	0.745	42.913
0.96	80.0	0.711	41.099
0.96	90.0	0.700	40.522
0.97	0.5	46.142	289.522
0.97	1.0	32.887	287.403
0.97	2.0	21.065	282.053
0.97	3.0	15.084	273.007
0.97	4.0	11.617	260.676
0.97	5.0	9.433	246.894
0.97	6.0	7.957	233.147
0.97	8.0	6.102	208.455
0.97	10.0	4.826	184.742
0.97	12.0	4.081	167.401
0.97	15.0	3.278	145.274
0.97	20.0	2.481	119.023
0.97	25.0	2.008	101.102
0.97	30.0	1.697	88.262
0.97	35.0	1.479	78.721
0.97	40.0	1.320	71.441
0.97	45.0	1.200	65.779
0.97	50.0	1.108	61.321
0.97	60.0	0.980	54.993
0.97	70.0	0.903	51.104
0.97	80.0	0.862	48.981
0.97	90.0	0.849	48.306

DSN Canberra Stations (Frequency = 32.05 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.98	0.5	55.477	289.782
0.98	1.0	40.773	287.927
0.98	2.0	26.727	284.344
0.98	3.0	19.254	279.199
0.98	4.0	14.832	271.546
0.98	5.0	12.053	261.984
0.98	6.0	10.195	251.678
0.98	8.0	7.836	231.263
0.98	10.0	6.178	209.347
0.98	12.0	5.235	192.748
0.98	15.0	4.206	170.254
0.98	20.0	3.183	142.199
0.98	25.0	2.576	122.273
0.98	30.0	2.177	107.641
0.98	35.0	1.898	96.585
0.98	40.0	1.693	88.047
0.98	45.0	1.539	81.347
0.98	50.0	1.421	76.037
0.98	60.0	1.257	68.445
0.98	70.0	1.158	63.748
0.98	80.0	1.105	61.176
0.98	90.0	1.089	60.355
0.99	0.5	74.393	290.056
0.99	1.0	56.748	288.383
0.99	2.0	38.189	285.695
0.99	3.0	27.695	283.141
0.99	4.0	21.342	279.884
0.99	5.0	17.358	275.431
0.99	6.0	14.726	270.034
0.99	8.0	11.346	257.481
0.99	10.0	8.915	241.192
0.99	12.0	7.572	227.675
0.99	15.0	6.083	207.298
0.99	20.0	4.603	179.208
0.99	25.0	3.725	157.619
0.99	30.0	3.149	140.960
0.99	35.0	2.745	127.941
0.99	40.0	2.449	117.640
0.99	45.0	2.226	109.412
0.99	50.0	2.055	102.800
0.99	60.0	1.818	93.211
0.99	70.0	1.675	87.200
0.99	80.0	1.599	83.883
0.99	90.0	1.574	82.821

Madrid Stations
Ka-Band (32.05 GHz)

DSN Madrid Stations (Frequency = 32.05 GHz)			
CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.00	0.5	14.126	259.037
0.00	1.0	7.063	211.411
0.00	2.0	3.532	144.158
0.00	3.0	2.355	107.785
0.00	4.0	1.767	85.814
0.00	5.0	1.414	71.223
0.00	6.0	1.179	60.858
0.00	8.0	0.886	47.143
0.00	10.0	0.710	38.497
0.00	12.0	0.593	32.557
0.00	15.0	0.476	26.483
0.00	20.0	0.360	20.293
0.00	25.0	0.292	16.546
0.00	30.0	0.247	14.054
0.00	35.0	0.215	12.293
0.00	40.0	0.192	10.997
0.00	45.0	0.174	10.016
0.00	50.0	0.161	9.259
0.00	60.0	0.142	8.207
0.00	70.0	0.131	7.572
0.00	80.0	0.125	7.230
0.00	90.0	0.123	7.122
0.10	0.5	16.145	265.948
0.10	1.0	8.620	230.730
0.10	2.0	4.523	170.633
0.10	3.0	3.062	132.626
0.10	4.0	2.316	108.040
0.10	5.0	1.861	90.909
0.10	6.0	1.552	78.246
0.10	8.0	1.170	61.396
0.10	10.0	0.938	50.438
0.10	12.0	0.784	42.869
0.10	15.0	0.630	35.010
0.10	20.0	0.477	26.935
0.10	25.0	0.386	22.014
0.10	30.0	0.326	18.728
0.10	35.0	0.284	16.400
0.10	40.0	0.254	14.683
0.10	45.0	0.231	13.381
0.10	50.0	0.213	12.375
0.10	60.0	0.188	10.976
0.10	70.0	0.173	10.132
0.10	80.0	0.166	9.676
0.10	90.0	0.163	9.532

DSN Madrid Stations (Frequency = 32.05 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.20	0.5	16.842	268.294
0.20	1.0	9.177	236.555
0.20	2.0	4.890	179.283
0.20	3.0	3.326	141.130
0.20	4.0	2.522	115.803
0.20	5.0	2.028	97.892
0.20	6.0	1.692	84.522
0.20	8.0	1.277	66.630
0.20	10.0	1.023	54.824
0.20	12.0	0.856	46.696
0.20	15.0	0.688	38.193
0.20	20.0	0.520	29.427
0.20	25.0	0.421	24.072
0.20	30.0	0.356	20.491
0.20	35.0	0.310	17.952
0.20	40.0	0.277	16.077
0.20	45.0	0.252	14.655
0.20	50.0	0.232	13.556
0.20	60.0	0.206	12.026
0.20	70.0	0.189	11.103
0.20	80.0	0.181	10.604
0.20	90.0	0.178	10.447
0.25	0.5	17.120	269.270
0.25	1.0	9.401	238.796
0.25	2.0	5.038	182.627
0.25	3.0	3.433	144.455
0.25	4.0	2.604	118.861
0.25	5.0	2.095	100.656
0.25	6.0	1.748	87.015
0.25	8.0	1.321	68.718
0.25	10.0	1.058	56.580
0.25	12.0	0.885	48.230
0.25	15.0	0.711	39.471
0.25	20.0	0.538	30.431
0.25	25.0	0.435	24.902
0.25	30.0	0.368	21.203
0.25	35.0	0.321	18.578
0.25	40.0	0.286	16.640
0.25	45.0	0.260	15.170
0.25	50.0	0.240	14.033
0.25	60.0	0.213	12.451
0.25	70.0	0.196	11.496
0.25	80.0	0.187	10.980
0.25	90.0	0.184	10.816

DSN Madrid Stations (Frequency = 32.05 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.30	0.5	17.387	270.206
0.30	1.0	9.615	240.886
0.30	2.0	5.180	185.763
0.30	3.0	3.535	147.593
0.30	4.0	2.684	121.761
0.30	5.0	2.160	103.285
0.30	6.0	1.803	89.390
0.30	8.0	1.362	70.713
0.30	10.0	1.091	58.261
0.30	12.0	0.913	49.701
0.30	15.0	0.733	40.698
0.30	20.0	0.555	31.394
0.30	25.0	0.449	25.700
0.30	30.0	0.380	21.887
0.30	35.0	0.331	19.180
0.30	40.0	0.295	17.182
0.30	45.0	0.268	15.665
0.30	50.0	0.248	14.492
0.30	60.0	0.219	12.859
0.30	70.0	0.202	11.873
0.30	80.0	0.193	11.341
0.30	90.0	0.190	11.172
0.40	0.5	17.942	272.069
0.40	1.0	10.060	244.984
0.40	2.0	5.475	191.991
0.40	3.0	3.747	153.897
0.40	4.0	2.848	127.625
0.40	5.0	2.294	108.627
0.40	6.0	1.915	94.233
0.40	8.0	1.448	74.796
0.40	10.0	1.159	61.710
0.40	12.0	0.971	52.724
0.40	15.0	0.780	43.224
0.40	20.0	0.590	33.383
0.40	25.0	0.478	27.347
0.40	30.0	0.404	23.300
0.40	35.0	0.352	20.426
0.40	40.0	0.314	18.302
0.40	45.0	0.285	16.689
0.40	50.0	0.264	15.442
0.40	60.0	0.233	13.705
0.40	70.0	0.215	12.656
0.40	80.0	0.205	12.089
0.40	90.0	0.202	11.909

DSN Madrid Stations (Frequency = 32.05 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.50	0.5	18.534	273.936
0.50	1.0	10.535	249.028
0.50	2.0	5.789	198.267
0.50	3.0	3.974	160.353
0.50	4.0	3.024	133.690
0.50	5.0	2.437	114.186
0.50	6.0	2.035	99.298
0.50	8.0	1.541	79.092
0.50	10.0	1.233	65.352
0.50	12.0	1.033	55.924
0.50	15.0	0.830	45.905
0.50	20.0	0.628	35.498
0.50	25.0	0.508	29.102
0.50	30.0	0.429	24.808
0.50	35.0	0.374	21.756
0.50	40.0	0.334	19.499
0.50	45.0	0.304	17.784
0.50	50.0	0.280	16.457
0.50	60.0	0.248	14.609
0.50	70.0	0.228	13.492
0.50	80.0	0.218	12.889
0.50	90.0	0.215	12.698
0.60	0.5	19.228	275.899
0.60	1.0	11.089	253.291
0.60	2.0	6.155	205.065
0.60	3.0	4.238	167.477
0.60	4.0	3.229	140.459
0.60	5.0	2.604	120.439
0.60	6.0	2.175	105.024
0.60	8.0	1.648	83.980
0.60	10.0	1.318	69.515
0.60	12.0	1.105	59.591
0.60	15.0	0.887	48.987
0.60	20.0	0.671	37.936
0.60	25.0	0.543	31.128
0.60	30.0	0.459	26.551
0.60	35.0	0.400	23.294
0.60	40.0	0.357	20.883
0.60	45.0	0.325	19.051
0.60	50.0	0.300	17.633
0.60	60.0	0.265	15.657
0.60	70.0	0.244	14.462
0.60	80.0	0.233	13.816
0.60	90.0	0.230	13.612

DSN Madrid Stations (Frequency = 32.05 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.70	0.5	20.123	278.059
0.70	1.0	11.801	258.086
0.70	2.0	6.625	213.024
0.70	3.0	4.576	176.024
0.70	4.0	3.492	148.699
0.70	5.0	2.817	128.123
0.70	6.0	2.355	112.108
0.70	8.0	1.785	90.077
0.70	10.0	1.427	74.737
0.70	12.0	1.197	64.207
0.70	15.0	0.961	52.879
0.70	20.0	0.728	41.027
0.70	25.0	0.589	33.702
0.70	30.0	0.498	28.768
0.70	35.0	0.434	25.252
0.70	40.0	0.387	22.648
0.70	45.0	0.352	20.667
0.70	50.0	0.325	19.133
0.70	60.0	0.287	16.994
0.70	70.0	0.265	15.700
0.70	80.0	0.253	15.001
0.70	90.0	0.249	14.779
0.80	0.5	21.679	280.839
0.80	1.0	13.032	264.709
0.80	2.0	7.436	224.858
0.80	3.0	5.160	189.249
0.80	4.0	3.944	161.748
0.80	5.0	3.186	140.474
0.80	6.0	2.664	123.616
0.80	8.0	2.022	100.110
0.80	10.0	1.616	83.406
0.80	12.0	1.356	71.911
0.80	15.0	1.089	59.412
0.80	20.0	0.824	46.245
0.80	25.0	0.667	38.062
0.80	30.0	0.564	32.532
0.80	35.0	0.491	28.582
0.80	40.0	0.439	25.651
0.80	45.0	0.399	23.419
0.80	50.0	0.368	21.690
0.80	60.0	0.326	19.275
0.80	70.0	0.300	17.813
0.80	80.0	0.286	17.023
0.80	90.0	0.282	16.772

DSN Madrid Stations (Frequency = 32.05 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.85	0.5	23.344	282.879
0.85	1.0	14.344	269.992
0.85	2.0	8.299	235.239
0.85	3.0	5.781	201.473
0.85	4.0	4.426	174.180
0.85	5.0	3.578	152.476
0.85	6.0	2.993	134.955
0.85	8.0	2.275	110.166
0.85	10.0	1.816	92.194
0.85	12.0	1.525	79.775
0.85	15.0	1.225	66.130
0.85	20.0	0.927	51.650
0.85	25.0	0.750	42.599
0.85	30.0	0.634	36.459
0.85	35.0	0.553	32.063
0.85	40.0	0.493	28.796
0.85	45.0	0.448	26.305
0.85	50.0	0.414	24.372
0.85	60.0	0.366	21.671
0.85	70.0	0.337	20.035
0.85	80.0	0.322	19.149
0.85	90.0	0.317	18.868
0.90	0.5	27.490	285.945
0.90	1.0	17.606	278.314
0.90	2.0	10.442	253.914
0.90	3.0	7.323	225.407
0.90	4.0	5.622	199.793
0.90	5.0	4.551	178.047
0.90	6.0	3.810	159.694
0.90	8.0	2.901	132.756
0.90	10.0	2.314	112.333
0.90	12.0	1.945	98.017
0.90	15.0	1.562	81.917
0.90	20.0	1.182	64.516
0.90	25.0	0.957	53.480
0.90	30.0	0.809	45.926
0.90	35.0	0.705	40.485
0.90	40.0	0.629	36.424
0.90	45.0	0.572	33.317
0.90	50.0	0.528	30.901
0.90	60.0	0.467	27.515
0.90	70.0	0.430	25.460
0.90	80.0	0.411	24.346
0.90	90.0	0.404	23.992

DSN Madrid Stations (Frequency = 32.05 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.92	0.5	30.986	287.442
0.92	1.0	20.354	282.273
0.92	2.0	12.247	264.230
0.92	3.0	8.622	240.174
0.92	4.0	6.629	216.700
0.92	5.0	5.370	195.691
0.92	6.0	4.498	177.309
0.92	8.0	3.428	149.476
0.92	10.0	2.733	127.636
0.92	12.0	2.299	112.101
0.92	15.0	1.846	94.315
0.92	20.0	1.397	74.792
0.92	25.0	1.131	62.258
0.92	30.0	0.956	53.615
0.92	35.0	0.833	47.357
0.92	40.0	0.743	42.668
0.92	45.0	0.676	39.072
0.92	50.0	0.624	36.270
0.92	60.0	0.552	32.335
0.92	70.0	0.509	29.941
0.92	80.0	0.485	28.642
0.92	90.0	0.478	28.229
0.93	0.5	32.395	287.890
0.93	1.0	21.479	283.424
0.93	2.0	13.022	267.404
0.93	3.0	9.187	245.102
0.93	4.0	7.065	222.671
0.93	5.0	5.725	202.153
0.93	6.0	4.800	183.949
0.93	8.0	3.661	156.012
0.93	10.0	2.916	133.716
0.93	12.0	2.454	117.801
0.93	15.0	1.971	99.407
0.93	20.0	1.492	79.076
0.93	25.0	1.207	65.950
0.93	30.0	1.020	56.867
0.93	35.0	0.889	50.275
0.93	40.0	0.794	45.328
0.93	45.0	0.722	41.529
0.93	50.0	0.666	38.566
0.93	60.0	0.589	34.400
0.93	70.0	0.543	31.864
0.93	80.0	0.518	30.487
0.93	90.0	0.510	30.050

DSN Madrid Stations (Frequency = 32.05 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.94	0.5	36.131	288.526
0.94	1.0	24.548	285.241
0.94	2.0	15.132	273.902
0.94	3.0	10.724	256.257
0.94	4.0	8.254	236.688
0.94	5.0	6.693	217.753
0.94	6.0	5.620	200.400
0.94	8.0	4.293	172.604
0.94	10.0	3.414	149.285
0.94	12.0	2.876	132.554
0.94	15.0	2.310	112.702
0.94	20.0	1.748	90.356
0.94	25.0	1.415	75.722
0.94	30.0	1.196	65.504
0.94	35.0	1.043	58.044
0.94	40.0	0.930	52.421
0.94	45.0	0.846	48.089
0.94	50.0	0.781	44.702
0.94	60.0	0.690	39.929
0.94	70.0	0.636	37.016
0.94	80.0	0.607	35.433
0.94	90.0	0.598	34.930
0.95	0.5	39.313	288.843
0.95	1.0	27.219	286.125
0.95	2.0	17.036	277.509
0.95	3.0	12.123	263.293
0.95	4.0	9.334	246.272
0.95	5.0	7.573	228.988
0.95	6.0	6.370	212.715
0.95	8.0	4.874	185.634
0.95	10.0	3.867	161.835
0.95	12.0	3.263	144.711
0.95	15.0	2.621	123.877
0.95	20.0	1.984	100.027
0.95	25.0	1.605	84.197
0.95	30.0	1.357	73.053
0.95	35.0	1.183	64.870
0.95	40.0	1.055	58.678
0.95	45.0	0.959	53.893
0.95	50.0	0.886	50.144
0.95	60.0	0.783	44.848
0.95	70.0	0.722	41.608
0.95	80.0	0.689	39.845
0.95	90.0	0.678	39.284

DSN Madrid Stations (Frequency = 32.05 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.96	0.5	43.210	289.103
0.96	1.0	30.507	286.773
0.96	2.0	19.393	280.346
0.96	3.0	13.858	269.457
0.96	4.0	10.672	255.322
0.96	5.0	8.663	240.126
0.96	6.0	7.301	225.335
0.96	8.0	5.595	199.574
0.96	10.0	4.430	175.681
0.96	12.0	3.743	158.362
0.96	15.0	3.007	136.670
0.96	20.0	2.275	111.312
0.96	25.0	1.841	94.201
0.96	30.0	1.556	82.030
0.96	35.0	1.357	73.031
0.96	40.0	1.211	66.188
0.96	45.0	1.101	60.880
0.96	50.0	1.016	56.709
0.96	60.0	0.899	50.800
0.96	70.0	0.828	47.176
0.96	80.0	0.790	45.200
0.96	90.0	0.778	44.572
0.97	0.5	48.168	289.322
0.97	1.0	34.701	287.242
0.97	2.0	22.407	282.444
0.97	3.0	16.079	274.593
0.97	4.0	12.384	263.580
0.97	5.0	10.059	250.918
0.97	6.0	8.493	238.060
0.97	8.0	6.518	214.396
0.97	10.0	5.150	190.999
0.97	12.0	4.358	173.790
0.97	15.0	3.501	151.483
0.97	20.0	2.649	124.700
0.97	25.0	2.144	106.241
0.97	30.0	1.812	92.937
0.97	35.0	1.580	83.013
0.97	40.0	1.410	75.418
0.97	45.0	1.281	69.498
0.97	50.0	1.183	64.830
0.97	60.0	1.046	58.192
0.97	70.0	0.964	54.106
0.97	80.0	0.920	51.874
0.97	90.0	0.906	51.164

DSN Madrid Stations (Frequency = 32.05 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.98	0.5	55.506	289.558
0.98	1.0	40.896	287.659
0.98	2.0	26.850	284.034
0.98	3.0	19.351	278.911
0.98	4.0	14.908	271.325
0.98	5.0	12.115	261.846
0.98	6.0	10.249	251.623
0.98	8.0	7.879	231.339
0.98	10.0	6.210	209.501
0.98	12.0	5.264	192.960
0.98	15.0	4.228	170.508
0.98	20.0	3.200	142.472
0.98	25.0	2.589	122.543
0.98	30.0	2.189	107.899
0.98	35.0	1.908	96.830
0.98	40.0	1.703	88.279
0.98	45.0	1.548	81.569
0.98	50.0	1.429	76.248
0.98	60.0	1.264	68.641
0.98	70.0	1.165	63.934
0.98	80.0	1.111	61.356
0.98	90.0	1.094	60.534
0.99	0.5	69.492	289.804
0.99	1.0	52.710	288.052
0.99	2.0	35.329	285.190
0.99	3.0	25.595	282.269
0.99	4.0	19.723	278.316
0.99	5.0	16.039	272.945
0.99	6.0	13.601	266.589
0.99	8.0	10.475	252.328
0.99	10.0	8.235	234.605
0.99	12.0	6.992	220.259
0.99	15.0	5.617	199.165
0.99	20.0	4.250	170.799
0.99	25.0	3.440	149.420
0.99	30.0	2.907	133.124
0.99	35.0	2.535	120.495
0.99	40.0	2.262	110.563
0.99	45.0	2.056	102.665
0.99	50.0	1.898	96.339
0.99	60.0	1.679	87.197
0.99	70.0	1.547	81.487
0.99	80.0	1.476	78.341
0.99	90.0	1.454	77.334

DSN Stations
K-Band (26.0 GHz)

Goldstone Stations
K-Band (26.0 GHz)

DSN Goldstone Stations K-Band (Frequency = 26.0 GHz)			
CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.00	0.5	8.943	230.473
0.00	1.0	4.472	166.603
0.00	2.0	2.236	103.146
0.00	3.0	1.491	74.197
0.00	4.0	1.119	57.868
0.00	5.0	0.895	47.419
0.00	6.0	0.747	40.167
0.00	8.0	0.561	30.774
0.00	10.0	0.449	24.961
0.00	12.0	0.375	21.015
0.00	15.0	0.302	17.017
0.00	20.0	0.228	12.980
0.00	25.0	0.185	10.555
0.00	30.0	0.156	8.949
0.00	35.0	0.136	7.818
0.00	40.0	0.121	6.987
0.00	45.0	0.110	6.360
0.00	50.0	0.102	5.876
0.00	60.0	0.090	5.204
0.00	70.0	0.083	4.800
0.00	80.0	0.079	4.582
0.00	90.0	0.078	4.513
0.10	0.5	10.651	245.201
0.10	1.0	5.757	194.057
0.10	2.0	3.027	131.330
0.10	3.0	2.049	98.045
0.10	4.0	1.554	78.243
0.10	5.0	1.249	64.931
0.10	6.0	1.039	55.226
0.10	8.0	0.783	42.758
0.10	10.0	0.629	34.936
0.10	12.0	0.525	29.498
0.10	15.0	0.422	23.962
0.10	20.0	0.319	18.337
0.10	25.0	0.258	14.938
0.10	30.0	0.218	12.682
0.10	35.0	0.190	11.089
0.10	40.0	0.170	9.917
0.10	45.0	0.154	9.030
0.10	50.0	0.143	8.346
0.10	60.0	0.126	7.396
0.10	70.0	0.116	6.824
0.10	80.0	0.111	6.515
0.10	90.0	0.109	6.417

DSN Goldstone Stations K-Band (Frequency = 26.0 GHz)			
CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.20	0.5	11.206	249.272
0.20	1.0	6.189	201.797
0.20	2.0	3.303	140.133
0.20	3.0	2.246	105.843
0.20	4.0	1.707	85.018
0.20	5.0	1.373	70.833
0.20	6.0	1.143	60.389
0.20	8.0	0.862	46.934
0.20	10.0	0.693	38.403
0.20	12.0	0.579	32.478
0.20	15.0	0.465	26.413
0.20	20.0	0.352	20.235
0.20	25.0	0.285	16.497
0.20	30.0	0.241	14.011
0.20	35.0	0.210	12.255
0.20	40.0	0.187	10.963
0.20	45.0	0.170	9.984
0.20	50.0	0.157	9.229
0.20	60.0	0.139	8.180
0.20	70.0	0.128	7.548
0.20	80.0	0.122	7.207
0.20	90.0	0.120	7.099
0.25	0.5	11.446	250.962
0.25	1.0	6.376	204.967
0.25	2.0	3.423	143.813
0.25	3.0	2.332	109.143
0.25	4.0	1.773	87.904
0.25	5.0	1.427	73.360
0.25	6.0	1.188	62.608
0.25	8.0	0.896	48.736
0.25	10.0	0.720	39.903
0.25	12.0	0.602	33.769
0.25	15.0	0.483	27.477
0.25	20.0	0.366	21.061
0.25	25.0	0.296	17.175
0.25	30.0	0.250	14.590
0.25	35.0	0.218	12.763
0.25	40.0	0.195	11.419
0.25	45.0	0.177	10.400
0.25	50.0	0.163	9.614
0.25	60.0	0.144	8.522
0.25	70.0	0.133	7.864
0.25	80.0	0.127	7.509
0.25	90.0	0.125	7.396

DSN Goldstone Stations K-Band (Frequency = 26.0 GHz)			
CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.30	0.5	11.676	252.537
0.30	1.0	6.555	207.903
0.30	2.0	3.537	147.263
0.30	3.0	2.414	112.260
0.30	4.0	1.837	90.641
0.30	5.0	1.479	75.763
0.30	6.0	1.231	64.721
0.30	8.0	0.929	50.457
0.30	10.0	0.747	41.338
0.30	12.0	0.624	35.005
0.30	15.0	0.501	28.497
0.30	20.0	0.379	21.853
0.30	25.0	0.307	17.826
0.30	30.0	0.259	15.146
0.30	35.0	0.226	13.252
0.30	40.0	0.202	11.857
0.30	45.0	0.183	10.800
0.30	50.0	0.169	9.984
0.30	60.0	0.150	8.851
0.30	70.0	0.138	8.168
0.30	80.0	0.132	7.799
0.30	90.0	0.130	7.682
0.40	0.5	12.154	255.626
0.40	1.0	6.928	213.654
0.40	2.0	3.775	154.149
0.40	3.0	2.583	118.551
0.40	4.0	1.969	96.201
0.40	5.0	1.587	80.663
0.40	6.0	1.321	69.046
0.40	8.0	0.998	53.990
0.40	10.0	0.801	44.291
0.40	12.0	0.670	37.554
0.40	15.0	0.538	30.603
0.40	20.0	0.407	23.492
0.40	25.0	0.330	19.175
0.40	30.0	0.279	16.298
0.40	35.0	0.243	14.264
0.40	40.0	0.217	12.765
0.40	45.0	0.197	11.629
0.40	50.0	0.182	10.752
0.40	60.0	0.161	9.533
0.40	70.0	0.148	8.798
0.40	80.0	0.141	8.401
0.40	90.0	0.139	8.276

DSN Goldstone Stations K-Band (Frequency = 26.0 GHz)			
CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.50	0.5	12.693	258.792
0.50	1.0	7.347	219.596
0.50	2.0	4.043	161.480
0.50	3.0	2.775	125.358
0.50	4.0	2.118	102.271
0.50	5.0	1.708	86.046
0.50	6.0	1.422	73.820
0.50	8.0	1.075	57.913
0.50	10.0	0.863	47.579
0.50	12.0	0.722	40.398
0.50	15.0	0.580	32.958
0.50	20.0	0.439	25.329
0.50	25.0	0.355	20.688
0.50	30.0	0.300	17.593
0.50	35.0	0.262	15.402
0.50	40.0	0.233	13.786
0.50	45.0	0.212	12.562
0.50	50.0	0.196	11.616
0.50	60.0	0.173	10.301
0.50	70.0	0.160	9.508
0.50	80.0	0.152	9.080
0.50	90.0	0.150	8.944
0.60	0.5	13.349	262.191
0.60	1.0	7.856	226.077
0.60	2.0	4.368	169.766
0.60	3.0	3.007	133.205
0.60	4.0	2.298	109.344
0.60	5.0	1.854	92.365
0.60	6.0	1.544	79.455
0.60	8.0	1.168	62.572
0.60	10.0	0.938	51.501
0.60	12.0	0.784	43.801
0.60	15.0	0.630	35.783
0.60	20.0	0.477	27.539
0.60	25.0	0.386	22.512
0.60	30.0	0.326	19.154
0.60	35.0	0.284	16.775
0.60	40.0	0.254	15.020
0.60	45.0	0.231	13.689
0.60	50.0	0.213	12.661
0.60	60.0	0.188	11.230
0.60	70.0	0.174	10.366
0.60	80.0	0.166	9.900
0.60	90.0	0.163	9.753

DSN Goldstone Stations K-Band (Frequency = 26.0 GHz)			
CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.70	0.5	14.141	265.762
0.70	1.0	8.469	232.985
0.70	2.0	4.760	178.967
0.70	3.0	3.286	142.120
0.70	4.0	2.515	117.482
0.70	5.0	2.031	99.698
0.70	6.0	1.691	86.037
0.70	8.0	1.281	68.058
0.70	10.0	1.028	56.139
0.70	12.0	0.860	47.838
0.70	15.0	0.691	39.147
0.70	20.0	0.523	30.178
0.70	25.0	0.423	24.694
0.70	30.0	0.358	21.025
0.70	35.0	0.312	18.422
0.70	40.0	0.278	16.500
0.70	45.0	0.253	15.042
0.70	50.0	0.233	13.915
0.70	60.0	0.206	12.346
0.70	70.0	0.190	11.399
0.70	80.0	0.182	10.887
0.70	90.0	0.179	10.725
0.80	0.5	15.143	269.565
0.80	1.0	9.243	240.470
0.80	2.0	5.254	189.432
0.80	3.0	3.638	152.549
0.80	4.0	2.789	127.154
0.80	5.0	2.254	108.508
0.80	6.0	1.877	94.011
0.80	8.0	1.422	74.767
0.80	10.0	1.142	61.845
0.80	12.0	0.955	52.825
0.80	15.0	0.767	43.319
0.80	20.0	0.581	33.465
0.80	25.0	0.470	27.419
0.80	30.0	0.397	23.365
0.80	35.0	0.346	20.485
0.80	40.0	0.309	18.356
0.80	45.0	0.281	16.739
0.80	50.0	0.259	15.489
0.80	60.0	0.229	13.747
0.80	70.0	0.211	12.695
0.80	80.0	0.202	12.127
0.80	90.0	0.199	11.947

DSN Goldstone Stations K-Band (Frequency = 26.0 GHz)			
CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.85	0.5	15.829	271.756
0.85	1.0	9.773	244.915
0.85	2.0	5.592	195.948
0.85	3.0	3.879	159.213
0.85	4.0	2.977	133.423
0.85	5.0	2.406	114.274
0.85	6.0	2.004	99.270
0.85	8.0	1.519	79.232
0.85	10.0	1.219	65.661
0.85	12.0	1.021	56.173
0.85	15.0	0.820	46.130
0.85	20.0	0.620	35.689
0.85	25.0	0.502	29.267
0.85	30.0	0.424	24.954
0.85	35.0	0.370	21.887
0.85	40.0	0.330	19.618
0.85	45.0	0.300	17.894
0.85	50.0	0.277	16.560
0.85	60.0	0.245	14.702
0.85	70.0	0.226	13.579
0.85	80.0	0.215	12.972
0.85	90.0	0.212	12.780
0.90	0.5	16.826	274.394
0.90	1.0	10.541	250.445
0.90	2.0	6.081	204.457
0.90	3.0	4.229	168.156
0.90	4.0	3.248	141.966
0.90	5.0	2.627	122.215
0.90	6.0	2.188	106.569
0.90	8.0	1.660	85.485
0.90	10.0	1.332	71.037
0.90	12.0	1.115	60.909
0.90	15.0	0.896	50.123
0.90	20.0	0.678	38.859
0.90	25.0	0.549	31.907
0.90	30.0	0.464	27.228
0.90	35.0	0.404	23.895
0.90	40.0	0.361	21.428
0.90	45.0	0.328	19.551
0.90	50.0	0.303	18.099
0.90	60.0	0.268	16.073
0.90	70.0	0.247	14.848
0.90	80.0	0.235	14.187
0.90	90.0	0.232	13.977

DSN Goldstone Stations K-Band (Frequency = 26.0 GHz)			
CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.92	0.5	17.489	275.837
0.92	1.0	11.051	253.605
0.92	2.0	6.406	209.565
0.92	3.0	4.460	173.670
0.92	4.0	3.428	147.315
0.92	5.0	2.773	127.236
0.92	6.0	2.311	111.221
0.92	8.0	1.753	89.507
0.92	10.0	1.407	74.514
0.92	12.0	1.178	63.984
0.92	15.0	0.946	52.726
0.92	20.0	0.716	40.934
0.92	25.0	0.579	33.639
0.92	30.0	0.490	28.722
0.92	35.0	0.427	25.216
0.92	40.0	0.381	22.619
0.92	45.0	0.346	20.643
0.92	50.0	0.320	19.112
0.92	60.0	0.283	16.977
0.92	70.0	0.261	15.686
0.92	80.0	0.249	14.988
0.92	90.0	0.245	14.766
0.93	0.5	17.975	276.768
0.93	1.0	11.425	255.700
0.93	2.0	6.644	213.062
0.93	3.0	4.630	177.513
0.93	4.0	3.560	151.078
0.93	5.0	2.880	130.794
0.93	6.0	2.400	114.535
0.93	8.0	1.821	92.390
0.93	10.0	1.461	77.015
0.93	12.0	1.224	66.202
0.93	15.0	0.983	54.608
0.93	20.0	0.744	42.438
0.93	25.0	0.602	34.897
0.93	30.0	0.509	29.808
0.93	35.0	0.444	26.177
0.93	40.0	0.396	23.486
0.93	45.0	0.360	21.437
0.93	50.0	0.332	19.851
0.93	60.0	0.294	17.636
0.93	70.0	0.271	16.296
0.93	80.0	0.258	15.572
0.93	90.0	0.254	15.342

DSN Goldstone Stations K-Band (Frequency = 26.0 GHz)			
CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.94	0.5	18.601	277.849
0.94	1.0	11.906	258.171
0.94	2.0	6.951	217.295
0.94	3.0	4.849	182.241
0.94	4.0	3.730	155.754
0.94	5.0	3.019	135.242
0.94	6.0	2.515	118.698
0.94	8.0	1.909	96.033
0.94	10.0	1.532	80.187
0.94	12.0	1.283	69.022
0.94	15.0	1.031	57.007
0.94	20.0	0.780	44.361
0.94	25.0	0.631	36.506
0.94	30.0	0.534	31.199
0.94	35.0	0.465	27.409
0.94	40.0	0.415	24.598
0.94	45.0	0.377	22.457
0.94	50.0	0.348	20.798
0.94	60.0	0.308	18.482
0.94	70.0	0.284	17.080
0.94	80.0	0.271	16.322
0.94	90.0	0.267	16.082
0.95	0.5	19.473	279.165
0.95	1.0	12.577	261.236
0.95	2.0	7.379	222.722
0.95	3.0	5.154	188.432
0.95	4.0	3.967	161.951
0.95	5.0	3.211	141.189
0.95	6.0	2.676	124.300
0.95	8.0	2.032	100.973
0.95	10.0	1.630	84.508
0.95	12.0	1.366	72.877
0.95	15.0	1.097	60.298
0.95	20.0	0.830	47.007
0.95	25.0	0.672	38.726
0.95	30.0	0.568	33.121
0.95	35.0	0.495	29.112
0.95	40.0	0.442	26.136
0.95	45.0	0.402	23.868
0.95	50.0	0.371	22.110
0.95	60.0	0.328	19.654
0.95	70.0	0.302	18.167
0.95	80.0	0.288	17.362
0.95	90.0	0.284	17.107

DSN Goldstone Stations K-Band (Frequency = 26.0 GHz)			
CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.96	0.5	20.759	280.788
0.96	1.0	13.565	265.084
0.96	2.0	8.008	229.834
0.96	3.0	5.603	196.785
0.96	4.0	4.316	170.462
0.96	5.0	3.495	149.455
0.96	6.0	2.913	132.159
0.96	8.0	2.213	107.980
0.96	10.0	1.775	90.680
0.96	12.0	1.487	78.410
0.96	15.0	1.195	65.044
0.96	20.0	0.904	50.841
0.96	25.0	0.732	41.952
0.96	30.0	0.618	35.918
0.96	35.0	0.539	31.595
0.96	40.0	0.481	28.381
0.96	45.0	0.437	25.930
0.96	50.0	0.404	24.027
0.96	60.0	0.357	21.368
0.96	70.0	0.329	19.756
0.96	80.0	0.314	18.884
0.96	90.0	0.309	18.608
0.97	0.5	22.818	282.829
0.97	1.0	15.148	270.010
0.97	2.0	9.017	239.447
0.97	3.0	6.323	208.556
0.97	4.0	4.875	182.763
0.97	5.0	3.950	161.615
0.97	6.0	3.292	143.881
0.97	8.0	2.502	118.607
0.97	10.0	2.007	100.136
0.97	12.0	1.682	86.949
0.97	15.0	1.351	72.422
0.97	20.0	1.022	56.846
0.97	25.0	0.827	47.028
0.97	30.0	0.699	40.332
0.97	35.0	0.610	35.521
0.97	40.0	0.544	31.936
0.97	45.0	0.494	29.197
0.97	50.0	0.456	27.069
0.97	60.0	0.404	24.090
0.97	70.0	0.372	22.283
0.97	80.0	0.355	21.305
0.97	90.0	0.350	20.994

DSN Goldstone Stations K-Band (Frequency = 26.0 GHz)			
CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.98	0.5	27.012	285.604
0.98	1.0	18.372	276.824
0.98	2.0	11.072	253.859
0.98	3.0	7.788	227.483
0.98	4.0	6.014	203.458
0.98	5.0	4.876	182.735
0.98	6.0	4.065	164.748
0.98	8.0	3.092	138.104
0.98	10.0	2.479	117.818
0.98	12.0	2.078	103.132
0.98	15.0	1.670	86.597
0.98	20.0	1.263	68.542
0.98	25.0	1.022	56.995
0.98	30.0	0.864	49.049
0.98	35.0	0.753	43.303
0.98	40.0	0.672	39.003
0.98	45.0	0.611	35.706
0.98	50.0	0.564	33.139
0.98	60.0	0.499	29.536
0.98	70.0	0.460	27.344
0.98	80.0	0.439	26.156
0.98	90.0	0.432	25.779
0.99	0.5	36.693	288.731
0.99	1.0	25.817	284.567
0.99	2.0	15.822	272.168
0.99	3.0	11.177	254.624
0.99	4.0	8.648	235.782
0.99	5.0	7.017	217.819
0.99	6.0	5.852	201.132
0.99	8.0	4.456	174.252
0.99	10.0	3.572	151.925
0.99	12.0	2.996	135.239
0.99	15.0	2.406	115.540
0.99	20.0	1.821	93.133
0.99	25.0	1.474	78.324
0.99	30.0	1.246	67.921
0.99	35.0	1.086	60.292
0.99	40.0	0.969	54.524
0.99	45.0	0.881	50.069
0.99	50.0	0.813	46.580
0.99	60.0	0.719	41.654
0.99	70.0	0.663	38.641
0.99	80.0	0.632	37.002
0.99	90.0	0.623	36.480

Canberra Stations
K-Band (26.0 GHz)

DSN Canberra Stations (Frequency = 26 GHz)			
CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.00	0.5	9.538	236.475
0.00	1.0	4.769	173.915
0.00	2.0	2.385	108.997
0.00	3.0	1.590	78.773
0.00	4.0	1.193	61.588
0.00	5.0	0.955	50.543
0.00	6.0	0.796	42.858
0.00	8.0	0.598	32.878
0.00	10.0	0.479	26.689
0.00	12.0	0.400	22.481
0.00	15.0	0.322	18.214
0.00	20.0	0.243	13.901
0.00	25.0	0.197	11.307
0.00	30.0	0.166	9.589
0.00	35.0	0.145	8.378
0.00	40.0	0.129	7.489
0.00	45.0	0.118	6.816
0.00	50.0	0.109	6.298
0.00	60.0	0.096	5.579
0.00	70.0	0.089	5.146
0.00	80.0	0.085	4.912
0.00	90.0	0.083	4.838
0.10	0.5	13.140	258.509
0.10	1.0	7.508	220.258
0.10	2.0	4.100	162.141
0.10	3.0	2.808	125.905
0.10	4.0	2.140	102.707
0.10	5.0	1.725	86.419
0.10	6.0	1.436	74.171
0.10	8.0	1.085	58.188
0.10	10.0	0.871	47.813
0.10	12.0	0.728	40.600
0.10	15.0	0.585	33.128
0.10	20.0	0.443	25.464
0.10	25.0	0.358	20.801
0.10	30.0	0.303	17.690
0.10	35.0	0.264	15.487
0.10	40.0	0.236	13.863
0.10	45.0	0.214	12.632
0.10	50.0	0.198	11.682
0.10	60.0	0.175	10.359
0.10	70.0	0.161	9.562
0.10	80.0	0.154	9.131
0.10	90.0	0.151	8.995

DSN Canberra Stations (Frequency = 26 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.20	0.5	14.008	262.198
0.20	1.0	8.181	228.063
0.20	2.0	4.530	172.608
0.20	3.0	3.114	135.951
0.20	4.0	2.379	111.816
0.20	5.0	1.919	94.585
0.20	6.0	1.598	81.470
0.20	8.0	1.209	64.241
0.20	10.0	0.970	52.914
0.20	12.0	0.812	45.030
0.20	15.0	0.652	36.811
0.20	20.0	0.493	28.347
0.20	25.0	0.399	23.182
0.20	30.0	0.337	19.729
0.20	35.0	0.294	17.281
0.20	40.0	0.262	15.475
0.20	45.0	0.239	14.105
0.20	50.0	0.220	13.047
0.20	60.0	0.195	11.573
0.20	70.0	0.180	10.684
0.20	80.0	0.171	10.204
0.20	90.0	0.169	10.052
0.25	0.5	14.369	263.679
0.25	1.0	8.462	231.079
0.25	2.0	4.710	176.741
0.25	3.0	3.242	139.984
0.25	4.0	2.478	115.508
0.25	5.0	2.000	97.917
0.25	6.0	1.665	84.464
0.25	8.0	1.260	66.739
0.25	10.0	1.012	55.027
0.25	12.0	0.846	46.870
0.25	15.0	0.680	38.344
0.25	20.0	0.514	29.551
0.25	25.0	0.416	24.177
0.25	30.0	0.352	20.583
0.25	35.0	0.307	18.033
0.25	40.0	0.274	16.151
0.25	45.0	0.249	14.723
0.25	50.0	0.230	13.619
0.25	60.0	0.203	12.083
0.25	70.0	0.187	11.155
0.25	80.0	0.179	10.655
0.25	90.0	0.176	10.496

DSN Canberra Stations (Frequency = 26 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.30	0.5	14.714	265.047
0.30	1.0	8.729	233.813
0.30	2.0	4.880	180.533
0.30	3.0	3.364	143.721
0.30	4.0	2.573	118.951
0.30	5.0	2.077	101.036
0.30	6.0	1.730	87.276
0.30	8.0	1.309	69.093
0.30	10.0	1.051	57.023
0.30	12.0	0.879	48.611
0.30	15.0	0.706	39.797
0.30	20.0	0.534	30.693
0.30	25.0	0.433	25.123
0.30	30.0	0.366	21.394
0.30	35.0	0.319	18.748
0.30	40.0	0.284	16.794
0.30	45.0	0.258	15.310
0.30	50.0	0.239	14.164
0.30	60.0	0.211	12.568
0.30	70.0	0.195	11.604
0.30	80.0	0.186	11.084
0.30	90.0	0.183	10.919
0.40	0.5	15.404	267.655
0.40	1.0	9.265	238.946
0.40	2.0	5.223	187.786
0.40	3.0	3.609	150.969
0.40	4.0	2.763	125.680
0.40	5.0	2.231	107.168
0.40	6.0	1.859	92.826
0.40	8.0	1.408	73.764
0.40	10.0	1.130	60.996
0.40	12.0	0.945	52.084
0.40	15.0	0.759	42.702
0.40	20.0	0.575	32.982
0.40	25.0	0.465	27.020
0.40	30.0	0.393	23.023
0.40	35.0	0.343	20.184
0.40	40.0	0.306	18.085
0.40	45.0	0.278	16.492
0.40	50.0	0.257	15.260
0.40	60.0	0.227	13.543
0.40	70.0	0.209	12.507
0.40	80.0	0.200	11.947
0.40	90.0	0.197	11.769

DSN Canberra Stations (Frequency = 26 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.50	0.5	16.167	270.252
0.50	1.0	9.857	244.030
0.50	2.0	5.601	195.197
0.50	3.0	3.879	158.530
0.50	4.0	2.973	132.785
0.50	5.0	2.402	113.697
0.50	6.0	2.001	98.772
0.50	8.0	1.516	78.806
0.50	10.0	1.217	65.304
0.50	12.0	1.018	55.862
0.50	15.0	0.818	45.873
0.50	20.0	0.619	35.489
0.50	25.0	0.501	29.102
0.50	30.0	0.423	24.813
0.50	35.0	0.369	21.763
0.50	40.0	0.329	19.507
0.50	45.0	0.299	17.793
0.50	50.0	0.276	16.467
0.50	60.0	0.245	14.618
0.50	70.0	0.225	13.502
0.50	80.0	0.215	12.898
0.50	90.0	0.212	12.707
0.60	0.5	17.110	273.009
0.60	1.0	10.587	249.498
0.60	2.0	6.067	203.500
0.60	3.0	4.211	167.218
0.60	4.0	3.232	141.069
0.60	5.0	2.612	121.383
0.60	6.0	2.176	105.828
0.60	8.0	1.650	84.843
0.60	10.0	1.324	70.490
0.60	12.0	1.108	60.427
0.60	15.0	0.890	49.720
0.60	20.0	0.674	38.541
0.60	25.0	0.545	31.643
0.60	30.0	0.461	27.001
0.60	35.0	0.402	23.695
0.60	40.0	0.359	21.248
0.60	45.0	0.326	19.387
0.60	50.0	0.301	17.946
0.60	60.0	0.266	15.937
0.60	70.0	0.245	14.723
0.60	80.0	0.234	14.066
0.60	90.0	0.230	13.858

DSN Canberra Stations (Frequency = 26 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.70	0.5	18.351	275.999
0.70	1.0	11.546	255.545
0.70	2.0	6.679	213.155
0.70	3.0	4.648	177.647
0.70	4.0	3.571	151.196
0.70	5.0	2.888	130.901
0.70	6.0	2.407	114.649
0.70	8.0	1.826	92.477
0.70	10.0	1.465	77.093
0.70	12.0	1.227	66.269
0.70	15.0	0.985	54.667
0.70	20.0	0.746	42.486
0.70	25.0	0.604	34.937
0.70	30.0	0.510	29.843
0.70	35.0	0.445	26.209
0.70	40.0	0.397	23.514
0.70	45.0	0.361	21.463
0.70	50.0	0.333	19.875
0.70	60.0	0.295	17.658
0.70	70.0	0.271	16.316
0.70	80.0	0.259	15.591
0.70	90.0	0.255	15.361
0.80	0.5	20.283	279.487
0.80	1.0	13.036	262.859
0.80	2.0	7.630	225.695
0.80	3.0	5.326	191.822
0.80	4.0	4.098	165.331
0.80	5.0	3.317	144.428
0.80	6.0	2.764	127.364
0.80	8.0	2.099	103.665
0.80	10.0	1.684	86.868
0.80	12.0	1.410	74.982
0.80	15.0	1.133	62.097
0.80	20.0	0.857	48.455
0.80	25.0	0.694	39.942
0.80	30.0	0.586	34.174
0.80	35.0	0.511	30.046
0.80	40.0	0.456	26.980
0.80	45.0	0.415	24.643
0.80	50.0	0.383	22.830
0.80	60.0	0.339	20.297
0.80	70.0	0.312	18.763
0.80	80.0	0.298	17.933
0.80	90.0	0.293	17.670

DSN Canberra Stations (Frequency = 26 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.85	0.5	21.922	281.636
0.85	1.0	14.298	267.567
0.85	2.0	8.434	234.403
0.85	3.0	5.900	202.170
0.85	4.0	4.544	175.959
0.85	5.0	3.680	154.808
0.85	6.0	3.067	137.274
0.85	8.0	2.330	112.549
0.85	10.0	1.869	94.720
0.85	12.0	1.566	82.037
0.85	15.0	1.258	68.163
0.85	20.0	0.952	53.368
0.85	25.0	0.770	44.082
0.85	30.0	0.651	37.767
0.85	35.0	0.567	33.238
0.85	40.0	0.506	29.867
0.85	45.0	0.460	27.294
0.85	50.0	0.425	25.297
0.85	60.0	0.376	22.503
0.85	70.0	0.346	20.810
0.85	80.0	0.331	19.893
0.85	90.0	0.325	19.602
0.90	0.5	25.063	284.461
0.90	1.0	16.715	274.054
0.90	2.0	9.975	247.413
0.90	3.0	7.000	218.579
0.90	4.0	5.399	193.443
0.90	5.0	4.374	172.326
0.90	6.0	3.647	154.333
0.90	8.0	2.772	128.212
0.90	10.0	2.223	108.768
0.90	12.0	1.863	94.793
0.90	15.0	1.497	79.248
0.90	20.0	1.133	62.441
0.90	25.0	0.917	51.777
0.90	30.0	0.775	44.475
0.90	35.0	0.675	39.212
0.90	40.0	0.603	35.284
0.90	45.0	0.548	32.277
0.90	50.0	0.506	29.939
0.90	60.0	0.447	26.662
0.90	70.0	0.412	24.672
0.90	80.0	0.393	23.594
0.90	90.0	0.387	23.251

DSN Canberra Stations (Frequency = 26 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.92	0.5	27.514	285.949
0.92	1.0	18.600	277.595
0.92	2.0	11.178	255.084
0.92	3.0	7.857	228.901
0.92	4.0	6.065	204.907
0.92	5.0	4.916	184.151
0.92	6.0	4.099	166.110
0.92	8.0	3.117	139.325
0.92	10.0	2.500	118.908
0.92	12.0	2.095	104.114
0.92	15.0	1.683	87.447
0.92	20.0	1.274	69.236
0.92	25.0	1.031	57.582
0.92	30.0	0.871	49.560
0.92	35.0	0.759	43.758
0.92	40.0	0.678	39.415
0.92	45.0	0.616	36.085
0.92	50.0	0.569	33.492
0.92	60.0	0.503	29.851
0.92	70.0	0.464	27.638
0.92	80.0	0.442	26.437
0.92	90.0	0.436	26.056
0.93	0.5	29.270	286.776
0.93	1.0	19.950	279.579
0.93	2.0	12.039	259.577
0.93	3.0	8.472	235.218
0.93	4.0	6.542	212.134
0.93	5.0	5.304	191.763
0.93	6.0	4.423	173.815
0.93	8.0	3.364	146.743
0.93	10.0	2.698	125.764
0.93	12.0	2.261	110.473
0.93	15.0	1.817	93.092
0.93	20.0	1.375	73.958
0.93	25.0	1.113	61.638
0.93	30.0	0.940	53.126
0.93	35.0	0.820	46.954
0.93	40.0	0.731	42.325
0.93	45.0	0.665	38.771
0.93	50.0	0.614	36.001
0.93	60.0	0.543	32.107
0.93	70.0	0.500	29.737
0.93	80.0	0.477	28.451
0.93	90.0	0.470	28.042

DSN Canberra Stations (Frequency = 26 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.94	0.5	31.618	287.660
0.94	1.0	21.756	281.715
0.94	2.0	13.191	264.583
0.94	3.0	9.294	242.526
0.94	4.0	7.181	220.720
0.94	5.0	5.824	200.979
0.94	6.0	4.856	183.284
0.94	8.0	3.695	156.032
0.94	10.0	2.963	134.453
0.94	12.0	2.484	118.601
0.94	15.0	1.995	100.371
0.94	20.0	1.510	80.099
0.94	25.0	1.222	66.942
0.94	30.0	1.033	57.806
0.94	35.0	0.900	51.158
0.94	40.0	0.803	46.160
0.94	45.0	0.730	42.316
0.94	50.0	0.674	39.315
0.94	60.0	0.596	35.092
0.94	70.0	0.550	32.517
0.94	80.0	0.524	31.119
0.94	90.0	0.516	30.675
0.95	0.5	32.968	288.366
0.95	1.0	22.851	283.602
0.95	2.0	13.940	268.859
0.95	3.0	9.838	248.476
0.95	4.0	7.602	227.481
0.95	5.0	6.167	208.033
0.95	6.0	5.146	190.385
0.95	8.0	3.919	162.835
0.95	10.0	3.139	140.656
0.95	12.0	2.633	124.361
0.95	15.0	2.115	105.463
0.95	20.0	1.601	84.339
0.95	25.0	1.296	70.576
0.95	30.0	1.095	60.994
0.95	35.0	0.955	54.012
0.95	40.0	0.852	48.757
0.95	45.0	0.774	44.712
0.95	50.0	0.715	41.551
0.95	60.0	0.632	37.101
0.95	70.0	0.583	34.386
0.95	80.0	0.556	32.911
0.95	90.0	0.548	32.443

DSN Canberra Stations (Frequency = 26 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.96	0.5	36.243	288.988
0.96	1.0	25.618	285.438
0.96	2.0	15.925	274.219
0.96	3.0	11.301	257.489
0.96	4.0	8.730	238.891
0.96	5.0	7.086	220.910
0.96	6.0	5.931	204.282
0.96	8.0	4.527	177.238
0.96	10.0	3.613	154.240
0.96	12.0	3.038	137.474
0.96	15.0	2.441	117.430
0.96	20.0	1.847	94.630
0.96	25.0	1.495	79.563
0.96	30.0	1.263	68.982
0.96	35.0	1.101	61.225
0.96	40.0	0.983	55.362
0.96	45.0	0.893	50.834
0.96	50.0	0.825	47.289
0.96	60.0	0.729	42.283
0.96	70.0	0.672	39.222
0.96	80.0	0.641	37.557
0.96	90.0	0.632	37.027
0.97	0.5	40.097	289.532
0.97	1.0	28.871	286.995
0.97	2.0	18.258	279.011
0.97	3.0	13.019	266.026
0.97	4.0	10.055	250.240
0.97	5.0	8.165	234.091
0.97	6.0	6.853	218.709
0.97	8.0	5.241	192.554
0.97	10.0	4.170	169.044
0.97	12.0	3.514	151.888
0.97	15.0	2.823	130.752
0.97	20.0	2.136	106.229
0.97	25.0	1.729	89.771
0.97	30.0	1.461	78.100
0.97	35.0	1.274	69.488
0.97	40.0	1.137	62.948
0.97	45.0	1.033	57.880
0.97	50.0	0.954	53.900
0.97	60.0	0.844	48.267
0.97	70.0	0.777	44.813
0.97	80.0	0.742	42.932
0.97	90.0	0.731	42.333

DSN Canberra Stations (Frequency = 26 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.98	0.5	46.292	289.966
0.98	1.0	34.107	288.141
0.98	2.0	22.018	283.089
0.98	3.0	15.788	274.478
0.98	4.0	12.190	262.728
0.98	5.0	9.905	249.617
0.98	6.0	8.340	236.479
0.98	8.0	6.393	212.577
0.98	10.0	5.067	189.293
0.98	12.0	4.280	172.080
0.98	15.0	3.438	149.928
0.98	20.0	2.602	123.389
0.98	25.0	2.106	105.118
0.98	30.0	1.780	91.956
0.98	35.0	1.552	82.138
0.98	40.0	1.384	74.626
0.98	45.0	1.259	68.770
0.98	50.0	1.162	64.153
0.98	60.0	1.028	57.587
0.98	70.0	0.947	53.545
0.98	80.0	0.904	51.337
0.98	90.0	0.890	50.634
0.99	0.5	58.885	290.337
0.99	1.0	44.740	288.893
0.99	2.0	29.646	285.919
0.99	3.0	21.405	281.736
0.99	4.0	16.522	275.476
0.99	5.0	13.435	267.440
0.99	6.0	11.355	258.538
0.99	8.0	8.728	240.213
0.99	10.0	6.889	219.644
0.99	12.0	5.835	203.678
0.99	15.0	4.687	181.479
0.99	20.0	3.547	153.075
0.99	25.0	2.871	132.478
0.99	30.0	2.426	117.150
0.99	35.0	2.115	105.463
0.99	40.0	1.887	96.377
0.99	45.0	1.716	89.213
0.99	50.0	1.584	83.512
0.99	60.0	1.401	75.330
0.99	70.0	1.291	70.251
0.99	80.0	1.232	67.462
0.99	90.0	1.213	66.572

Madrid Stations
K-Band (26.0 GHz)

Madrid Stations K-Band (Frequency = 26.0 GHz)			
CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.00	0.5	9.362	234.768
0.00	1.0	4.681	171.796
0.00	2.0	2.341	107.283
0.00	3.0	1.561	77.428
0.00	4.0	1.171	60.493
0.00	5.0	0.937	49.622
0.00	6.0	0.782	42.064
0.00	8.0	0.587	32.256
0.00	10.0	0.470	26.178
0.00	12.0	0.393	22.048
0.00	15.0	0.316	17.860
0.00	20.0	0.239	13.628
0.00	25.0	0.193	11.084
0.00	30.0	0.163	9.399
0.00	35.0	0.142	8.212
0.00	40.0	0.127	7.340
0.00	45.0	0.116	6.681
0.00	50.0	0.107	6.173
0.00	60.0	0.094	5.468
0.00	70.0	0.087	5.043
0.00	80.0	0.083	4.814
0.00	90.0	0.082	4.742
0.10	0.5	11.946	253.181
0.10	1.0	6.639	208.749
0.10	2.0	3.559	147.678
0.10	3.0	2.424	112.492
0.10	4.0	1.843	90.775
0.10	5.0	1.483	75.854
0.10	6.0	1.235	64.806
0.10	8.0	0.932	50.507
0.10	10.0	0.748	41.380
0.10	12.0	0.625	35.038
0.10	15.0	0.502	28.524
0.10	20.0	0.380	21.875
0.10	25.0	0.308	17.844
0.10	30.0	0.260	15.162
0.10	35.0	0.227	13.265
0.10	40.0	0.202	11.869
0.10	45.0	0.184	10.811
0.10	50.0	0.170	9.995
0.10	60.0	0.150	8.860
0.10	70.0	0.138	8.176
0.10	80.0	0.132	7.807
0.10	90.0	0.130	7.690

Madrid Stations K-Band (Frequency = 26.0 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.20	0.5	12.753	257.487
0.20	1.0	7.264	217.612
0.20	2.0	3.959	158.738
0.20	3.0	2.709	122.716
0.20	4.0	2.065	99.859
0.20	5.0	1.664	83.887
0.20	6.0	1.385	71.913
0.20	8.0	1.046	56.330
0.20	10.0	0.840	46.252
0.20	12.0	0.702	39.248
0.20	15.0	0.564	32.006
0.20	20.0	0.427	24.587
0.20	25.0	0.346	20.077
0.20	30.0	0.292	17.070
0.20	35.0	0.255	14.943
0.20	40.0	0.227	13.374
0.20	45.0	0.207	12.185
0.20	50.0	0.191	11.268
0.20	60.0	0.169	9.991
0.20	70.0	0.155	9.222
0.20	80.0	0.148	8.806
0.20	90.0	0.146	8.674
0.25	0.5	13.080	259.145
0.25	1.0	7.518	220.932
0.25	2.0	4.121	162.986
0.25	3.0	2.825	126.709
0.25	4.0	2.155	103.442
0.25	5.0	1.737	87.076
0.25	6.0	1.446	74.748
0.25	8.0	1.093	58.666
0.25	10.0	0.878	48.214
0.25	12.0	0.734	40.947
0.25	15.0	0.589	33.415
0.25	20.0	0.446	25.687
0.25	25.0	0.361	20.984
0.25	30.0	0.305	17.847
0.25	35.0	0.266	15.625
0.25	40.0	0.237	13.987
0.25	45.0	0.216	12.745
0.25	50.0	0.199	11.786
0.25	60.0	0.176	10.452
0.25	70.0	0.162	9.648
0.25	80.0	0.155	9.213
0.25	90.0	0.153	9.076

Madrid Stations K-Band (Frequency = 26.0 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.30	0.5	13.393	260.684
0.30	1.0	7.762	223.982
0.30	2.0	4.277	166.943
0.30	3.0	2.936	130.465
0.30	4.0	2.241	106.828
0.30	5.0	1.807	90.101
0.30	6.0	1.505	77.445
0.30	8.0	1.138	60.896
0.30	10.0	0.913	50.090
0.30	12.0	0.764	42.575
0.30	15.0	0.614	34.766
0.30	20.0	0.464	26.744
0.30	25.0	0.376	21.856
0.30	30.0	0.318	18.593
0.30	35.0	0.277	16.282
0.30	40.0	0.247	14.577
0.30	45.0	0.225	13.284
0.30	50.0	0.207	12.286
0.30	60.0	0.183	10.896
0.30	70.0	0.169	10.058
0.30	80.0	0.161	9.606
0.30	90.0	0.159	9.462
0.40	0.5	14.045	263.661
0.40	1.0	8.268	229.853
0.40	2.0	4.600	174.742
0.40	3.0	3.166	137.973
0.40	4.0	2.420	113.656
0.40	5.0	1.953	96.235
0.40	6.0	1.626	82.936
0.40	8.0	1.230	65.459
0.40	10.0	0.988	53.942
0.40	12.0	0.826	45.923
0.40	15.0	0.664	37.552
0.40	20.0	0.502	28.927
0.40	25.0	0.406	23.660
0.40	30.0	0.344	20.139
0.40	35.0	0.299	17.642
0.40	40.0	0.267	15.799
0.40	45.0	0.243	14.401
0.40	50.0	0.224	13.321
0.40	60.0	0.198	11.817
0.40	70.0	0.183	10.910
0.40	80.0	0.174	10.420
0.40	90.0	0.172	10.265

Madrid Stations K-Band (Frequency = 26.0 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.50	0.5	14.735	266.542
0.50	1.0	8.804	235.498
0.50	2.0	4.942	182.473
0.50	3.0	3.411	145.562
0.50	4.0	2.610	120.632
0.50	5.0	2.107	102.549
0.50	6.0	1.755	88.624
0.50	8.0	1.329	70.218
0.50	10.0	1.067	57.974
0.50	12.0	0.892	49.438
0.50	15.0	0.717	40.486
0.50	20.0	0.543	31.233
0.50	25.0	0.439	25.569
0.50	30.0	0.371	21.776
0.50	35.0	0.324	19.084
0.50	40.0	0.289	17.096
0.50	45.0	0.262	15.586
0.50	50.0	0.242	14.420
0.50	60.0	0.214	12.795
0.50	70.0	0.197	11.815
0.50	80.0	0.188	11.285
0.50	90.0	0.186	11.117
0.60	0.5	15.542	269.498
0.60	1.0	9.429	241.324
0.60	2.0	5.342	190.756
0.60	3.0	3.696	153.881
0.60	4.0	2.832	128.379
0.60	5.0	2.288	109.625
0.60	6.0	1.906	95.039
0.60	8.0	1.444	75.629
0.60	10.0	1.159	62.582
0.60	12.0	0.970	53.470
0.60	15.0	0.779	43.861
0.60	20.0	0.589	33.895
0.60	25.0	0.477	27.777
0.60	30.0	0.403	23.673
0.60	35.0	0.351	20.756
0.60	40.0	0.314	18.600
0.60	45.0	0.285	16.963
0.60	50.0	0.263	15.696
0.60	60.0	0.233	13.932
0.60	70.0	0.215	12.866
0.60	80.0	0.205	12.291
0.60	90.0	0.202	12.108

Madrid Stations K-Band (Frequency = 26.0 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.70	0.5	16.576	272.685
0.70	1.0	10.228	247.720
0.70	2.0	5.852	200.285
0.70	3.0	4.060	163.723
0.70	4.0	3.115	137.690
0.70	5.0	2.518	118.220
0.70	6.0	2.097	102.899
0.70	8.0	1.590	82.322
0.70	10.0	1.276	68.315
0.70	12.0	1.068	58.506
0.70	15.0	0.858	48.096
0.70	20.0	0.649	37.249
0.70	25.0	0.525	30.566
0.70	30.0	0.444	26.072
0.70	35.0	0.387	22.874
0.70	40.0	0.345	20.508
0.70	45.0	0.314	18.709
0.70	50.0	0.290	17.316
0.70	60.0	0.256	15.376
0.70	70.0	0.236	14.203
0.70	80.0	0.226	13.569
0.70	90.0	0.222	13.368
0.80	0.5	18.351	276.738
0.80	1.0	11.598	256.309
0.80	2.0	6.725	214.103
0.80	3.0	4.683	178.630
0.80	4.0	3.599	152.147
0.80	5.0	2.911	131.792
0.80	6.0	2.426	115.469
0.80	8.0	1.841	93.189
0.80	10.0	1.477	77.709
0.80	12.0	1.237	66.815
0.80	15.0	0.993	55.128
0.80	20.0	0.752	42.854
0.80	25.0	0.608	35.244
0.80	30.0	0.514	30.108
0.80	35.0	0.448	26.443
0.80	40.0	0.400	23.725
0.80	45.0	0.364	21.657
0.80	50.0	0.336	20.055
0.80	60.0	0.297	17.818
0.80	70.0	0.274	16.465
0.80	80.0	0.261	15.733
0.80	90.0	0.257	15.501

Madrid Stations K-Band (Frequency = 26.0 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.85	0.5	20.228	279.689
0.85	1.0	13.042	263.000
0.85	2.0	7.646	225.907
0.85	3.0	5.340	192.079
0.85	4.0	4.110	165.605
0.85	5.0	3.327	144.700
0.85	6.0	2.772	127.622
0.85	8.0	2.105	103.903
0.85	10.0	1.689	87.079
0.85	12.0	1.415	75.172
0.85	15.0	1.136	62.261
0.85	20.0	0.860	48.588
0.85	25.0	0.696	40.054
0.85	30.0	0.588	34.271
0.85	35.0	0.513	30.132
0.85	40.0	0.458	27.058
0.85	45.0	0.416	24.714
0.85	50.0	0.384	22.897
0.85	60.0	0.340	20.357
0.85	70.0	0.313	18.818
0.85	80.0	0.299	17.986
0.85	90.0	0.294	17.722
0.90	0.5	24.853	284.077
0.90	1.0	16.599	273.485
0.90	2.0	9.913	246.630
0.90	3.0	6.957	217.710
0.90	4.0	5.366	192.568
0.90	5.0	4.348	171.478
0.90	6.0	3.625	153.524
0.90	8.0	2.756	127.488
0.90	10.0	2.210	108.125
0.90	12.0	1.852	94.215
0.90	15.0	1.488	78.748
0.90	20.0	1.126	62.035
0.90	25.0	0.911	51.433
0.90	30.0	0.770	44.176
0.90	35.0	0.671	38.947
0.90	40.0	0.599	35.043
0.90	45.0	0.545	32.056
0.90	50.0	0.503	29.733
0.90	60.0	0.445	26.478
0.90	70.0	0.410	24.501
0.90	80.0	0.391	23.430
0.90	90.0	0.385	23.090

Madrid Stations K-Band (Frequency = 26.0 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.92	0.5	28.712	286.200
0.92	1.0	19.566	278.657
0.92	2.0	11.805	258.012
0.92	3.0	8.307	233.210
0.92	4.0	6.415	209.921
0.92	5.0	5.201	189.480
0.92	6.0	4.336	171.534
0.92	8.0	3.299	144.579
0.92	10.0	2.645	123.776
0.92	12.0	2.217	108.638
0.92	15.0	1.781	91.470
0.92	20.0	1.348	72.606
0.92	25.0	1.091	60.479
0.92	30.0	0.922	52.108
0.92	35.0	0.804	46.042
0.92	40.0	0.717	41.496
0.92	45.0	0.652	38.006
0.92	50.0	0.602	35.286
0.92	60.0	0.532	31.465
0.92	70.0	0.491	29.140
0.92	80.0	0.468	27.878
0.92	90.0	0.461	27.477
0.93	0.5	29.780	287.005
0.93	1.0	20.411	280.719
0.93	2.0	12.380	262.305
0.93	3.0	8.724	238.822
0.93	4.0	6.738	216.041
0.93	5.0	5.463	195.695
0.93	6.0	4.559	177.676
0.93	8.0	3.470	150.321
0.93	10.0	2.780	128.921
0.93	12.0	2.332	113.368
0.93	15.0	1.873	95.604
0.93	20.0	1.417	76.010
0.93	25.0	1.147	63.376
0.93	30.0	0.970	54.640
0.93	35.0	0.845	48.301
0.93	40.0	0.754	43.546
0.93	45.0	0.686	39.894
0.93	50.0	0.633	37.046
0.93	60.0	0.560	33.044
0.93	70.0	0.516	30.606
0.93	80.0	0.492	29.284
0.93	90.0	0.485	28.863

Madrid Stations K-Band (Frequency = 26.0 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.94	0.5	33.263	287.928
0.94	1.0	23.194	283.090
0.94	2.0	14.233	268.565
0.94	3.0	10.063	248.691
0.94	4.0	7.775	228.099
0.94	5.0	6.308	208.985
0.94	6.0	5.269	191.667
0.94	8.0	4.016	164.415
0.94	10.0	3.212	142.180
0.94	12.0	2.697	125.946
0.94	15.0	2.167	106.969
0.94	20.0	1.640	85.685
0.94	25.0	1.327	71.776
0.94	30.0	1.122	62.075
0.94	35.0	0.978	54.997
0.94	40.0	0.872	49.665
0.94	45.0	0.793	45.557
0.94	50.0	0.732	42.347
0.94	60.0	0.648	37.823
0.94	70.0	0.597	35.062
0.94	80.0	0.569	33.562
0.94	90.0	0.561	33.085
0.95	0.5	35.504	288.526
0.95	1.0	25.064	284.717
0.95	2.0	15.556	272.851
0.95	3.0	11.033	255.485
0.95	4.0	8.524	236.468
0.95	5.0	6.918	218.246
0.95	6.0	5.789	201.478
0.95	8.0	4.418	174.395
0.95	10.0	3.527	151.547
0.95	12.0	2.965	134.905
0.95	15.0	2.382	115.094
0.95	20.0	1.803	92.628
0.95	25.0	1.459	77.818
0.95	30.0	1.233	67.433
0.95	35.0	1.075	59.827
0.95	40.0	0.959	54.082
0.95	45.0	0.872	49.649
0.95	50.0	0.805	46.178
0.95	60.0	0.712	41.280
0.95	70.0	0.656	38.286
0.95	80.0	0.626	36.658
0.95	90.0	0.616	36.140

Madrid Stations K-Band (Frequency = 26.0 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.96	0.5	38.130	289.011
0.96	1.0	27.275	286.037
0.96	2.0	17.138	276.657
0.96	3.0	12.197	261.989
0.96	4.0	9.422	244.889
0.96	5.0	7.650	227.865
0.96	6.0	6.414	211.889
0.96	8.0	4.901	185.289
0.96	10.0	3.904	161.968
0.96	12.0	3.287	144.991
0.96	15.0	2.641	124.356
0.96	20.0	1.998	100.640
0.96	25.0	1.617	84.842
0.96	30.0	1.367	73.691
0.96	35.0	1.192	65.488
0.96	40.0	1.063	59.273
0.96	45.0	0.967	54.465
0.96	50.0	0.892	50.694
0.96	60.0	0.789	45.363
0.96	70.0	0.727	42.099
0.96	80.0	0.694	40.322
0.96	90.0	0.683	39.757
0.97	0.5	41.389	289.400
0.97	1.0	30.036	287.061
0.97	2.0	19.125	279.926
0.97	3.0	13.662	268.130
0.97	4.0	10.552	253.361
0.97	5.0	8.570	237.941
0.97	6.0	7.200	223.091
0.97	8.0	5.511	197.430
0.97	10.0	4.379	173.884
0.97	12.0	3.693	156.691
0.97	15.0	2.967	135.270
0.97	20.0	2.245	110.232
0.97	25.0	1.817	93.329
0.97	30.0	1.536	81.300
0.97	35.0	1.339	72.401
0.97	40.0	1.195	65.631
0.97	45.0	1.086	60.378
0.97	50.0	1.002	56.249
0.97	60.0	0.887	50.398
0.97	70.0	0.817	46.808
0.97	80.0	0.780	44.851
0.97	90.0	0.768	44.228

Madrid Stations K-Band (Frequency = 26.0 GHz)

CD	Elev Angle (deg)	A-atm (dB)	T-atm (K)
0.98	0.5	46.294	289.756
0.98	1.0	34.175	287.899
0.98	2.0	22.092	282.836
0.98	3.0	15.846	274.272
0.98	4.0	12.236	262.592
0.98	5.0	9.943	249.549
0.98	6.0	8.372	236.472
0.98	8.0	6.419	212.656
0.98	10.0	5.087	189.408
0.98	12.0	4.297	172.228
0.98	15.0	3.452	150.093
0.98	20.0	2.612	123.556
0.98	25.0	2.114	105.278
0.98	30.0	1.787	92.106
0.98	35.0	1.558	82.279
0.98	40.0	1.390	74.758
0.98	45.0	1.264	68.895
0.98	50.0	1.166	64.272
0.98	60.0	1.032	57.696
0.98	70.0	0.951	53.649
0.98	80.0	0.907	51.437
0.98	90.0	0.893	50.733
0.99	0.5	55.588	290.085
0.99	1.0	42.026	288.554
0.99	2.0	27.727	285.242
0.99	3.0	19.997	280.298
0.99	4.0	15.436	272.962
0.99	5.0	12.551	263.832
0.99	6.0	10.600	253.965
0.99	8.0	8.145	234.253
0.99	10.0	6.433	212.850
0.99	12.0	5.446	196.479
0.99	15.0	4.375	174.129
0.99	20.0	3.311	145.999
0.99	25.0	2.679	125.867
0.99	30.0	2.265	111.008
0.99	35.0	1.974	99.740
0.99	40.0	1.762	91.016
0.99	45.0	1.601	84.156
0.99	50.0	1.478	78.711
0.99	60.0	1.308	70.913
0.99	70.0	1.205	66.083
0.99	80.0	1.150	63.434
0.99	90.0	1.132	62.589

